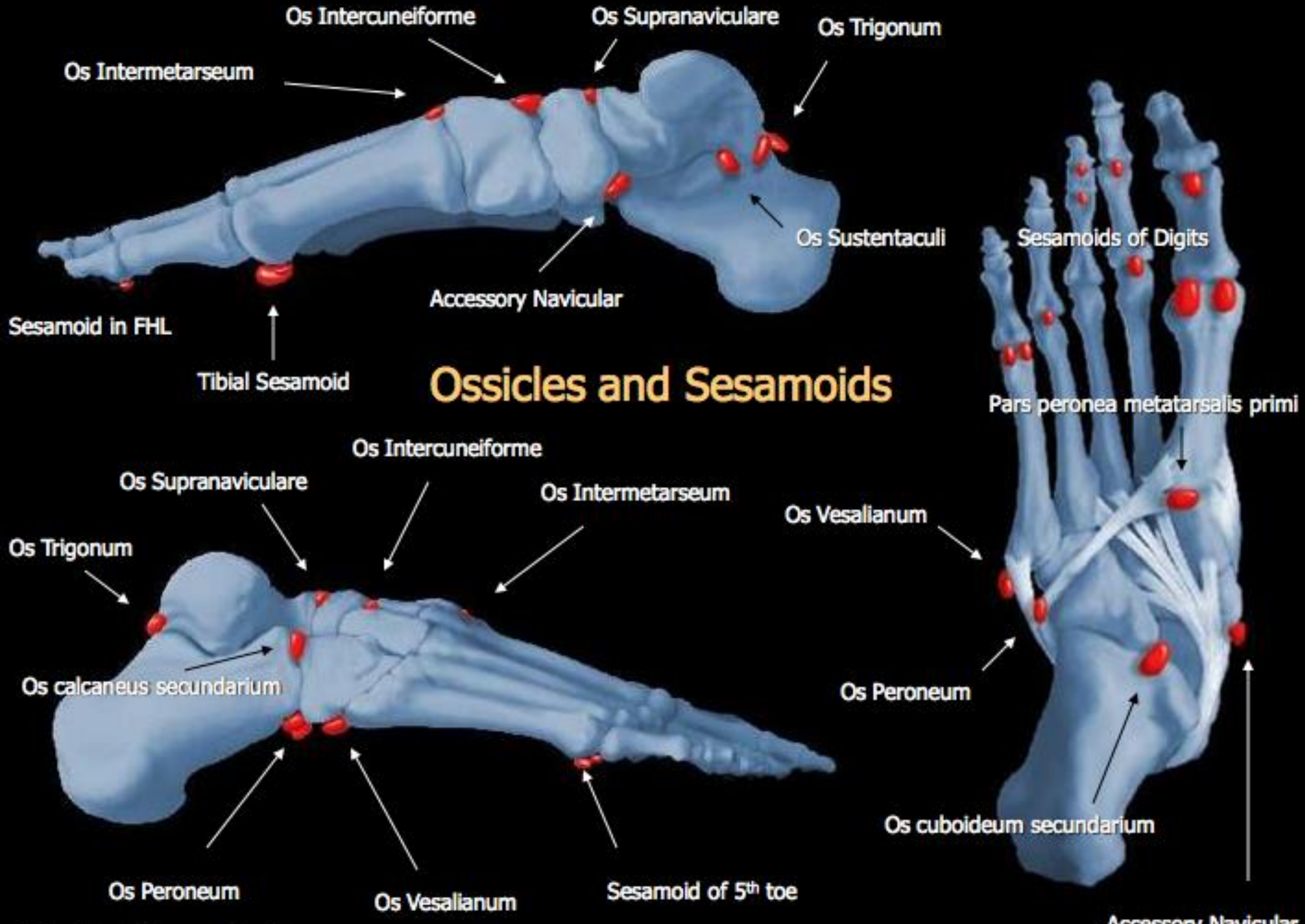
Erica Chu
3/7/2014

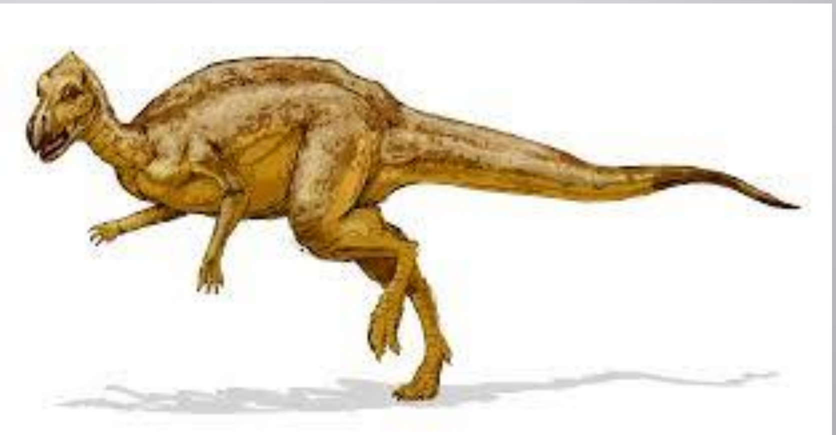
Little Bones

Ossicles and Sesamoids



Adapted from StatDx

What do these creatures have in common?



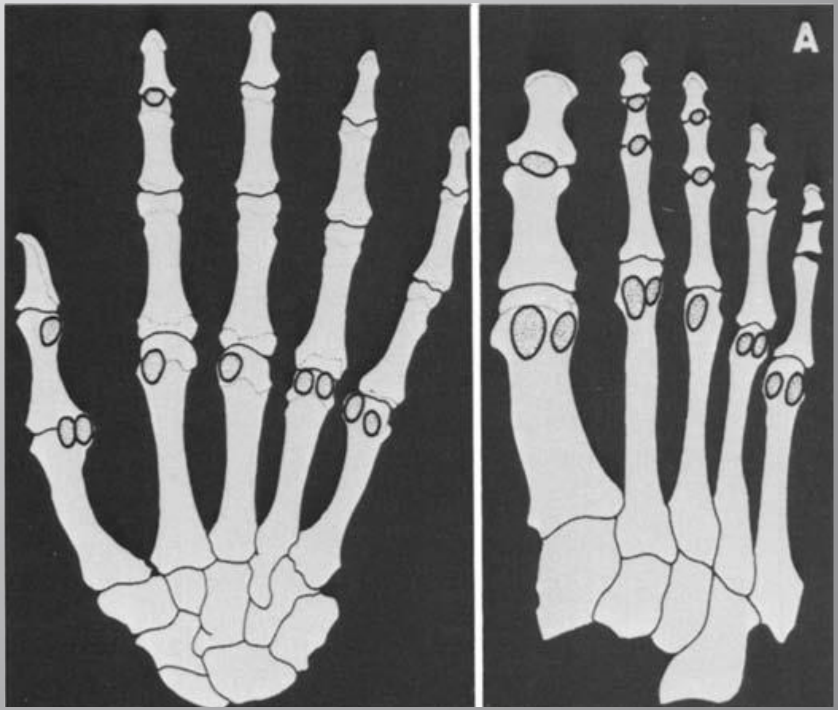
Sesame Seeds

Sesamoid Bones

- Foot
  - Hallucal sesamoids
  - Lesser metatarsal sesamoids
  - Interphalangeal joint sesamoid of great toe
  - Os peroneum
  - Sesamoid within tibialis anterior tendon
  - Sesamoid within the posterior tibialis tendon
- Hand
  - Pollicis sesamoids
  - Second and fifth metacarpal sesamoids
  - Interphalangeal joint sesamoid of thumb
  - Pisiform
- Patella
- Fabella

Sesamoid Bones

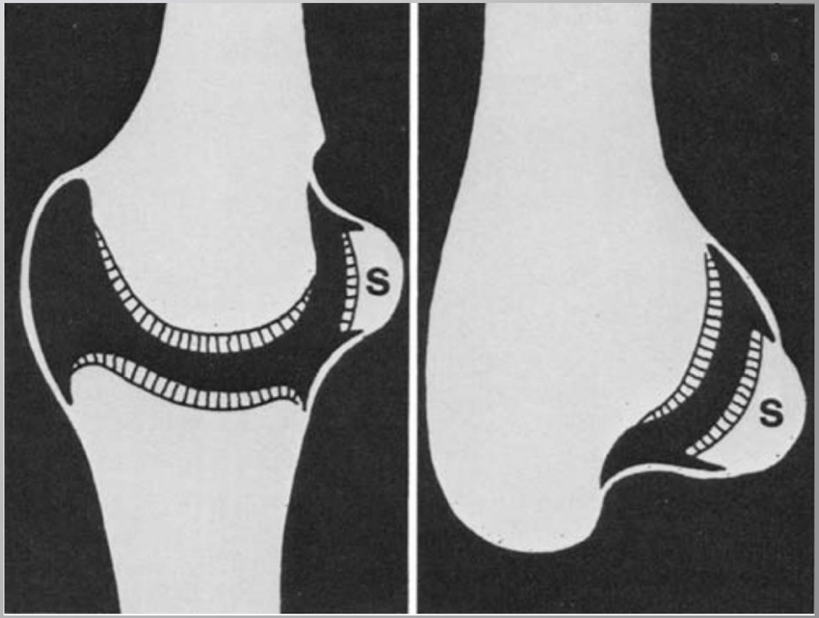
- Small round or ovoid bones embedded in certain tendons
- Usually related to joint surfaces
- Osseous surfaces covered by cartilage
- Intimate with synovial-lined cavity



Resnick D, Niwayama G, Feingold ML. The sesamoid bones of the hands and feet: participators in arthritis. Radiology 1977; 123:57-62.

Sesamoid Bones

- Two types
  - Type A: Sesamoid located adjacent to articulation
    - Patella
    - Hallucis sesamoids
    - Pollicis sesamoids
  - Type B: Bursa separates sesamoid from adjacent bone
    - Sesamoid of peroneus longus tendon



Type A Type B

Resnick D, Niwayama G, Feingold ML. The sesamoid bones of the hands and feet: participators in arthritis. Radiology 1977; 123:57-62.

Sesamoid Bones

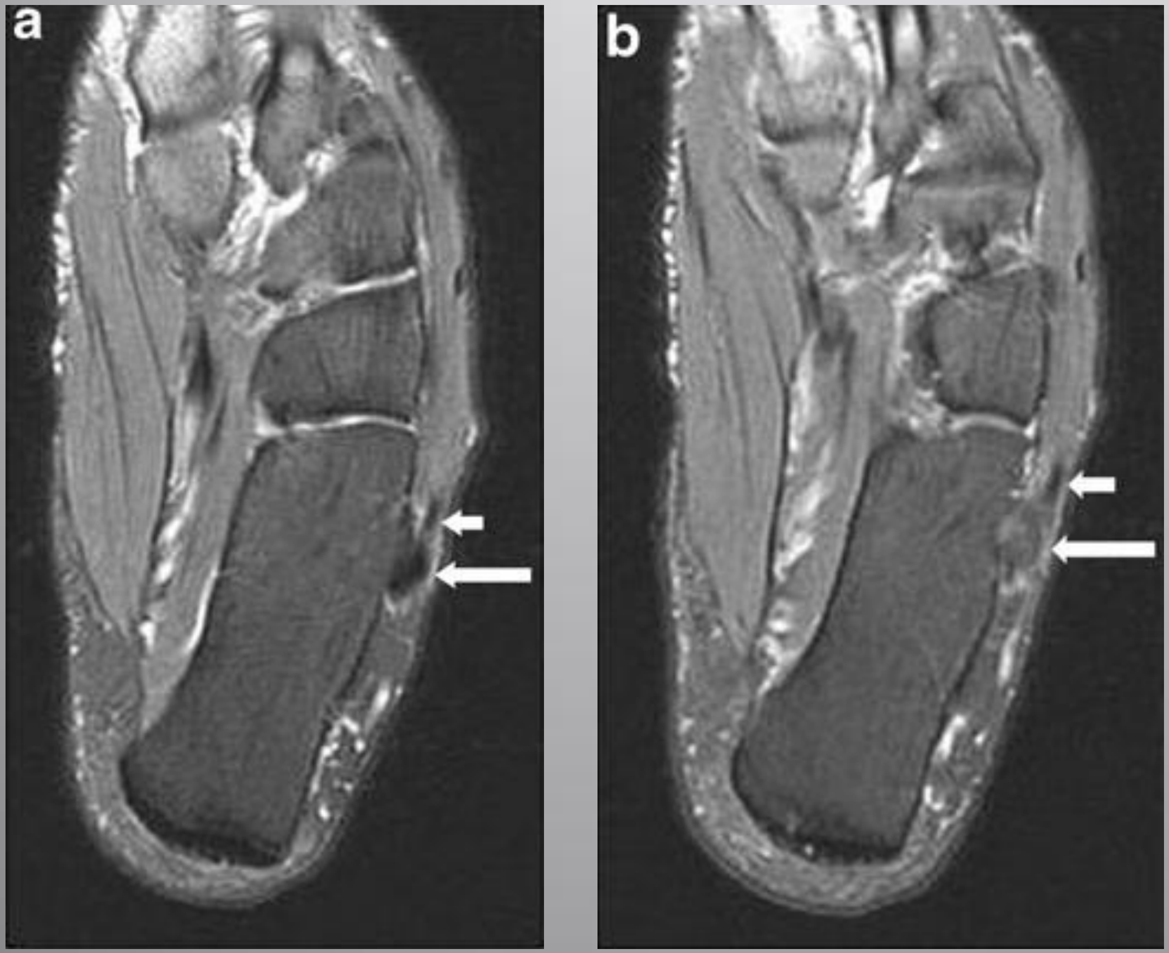
- Function
  - Protect tendons from damage
  - Increase efficiency or mechanical advantage of their associated muscle
    - Part of gliding mechanism
      - Modify pressure
      - Decrease friction
      - Alter muscle pull

“in proportion as the pastern is oblique or slanting, two consequences will follow, less weight will be thrown on the pastern, and more on the sesamoid…and in that proportion concussion will be prevented.”

Fibrocartilaginous Sesamoids

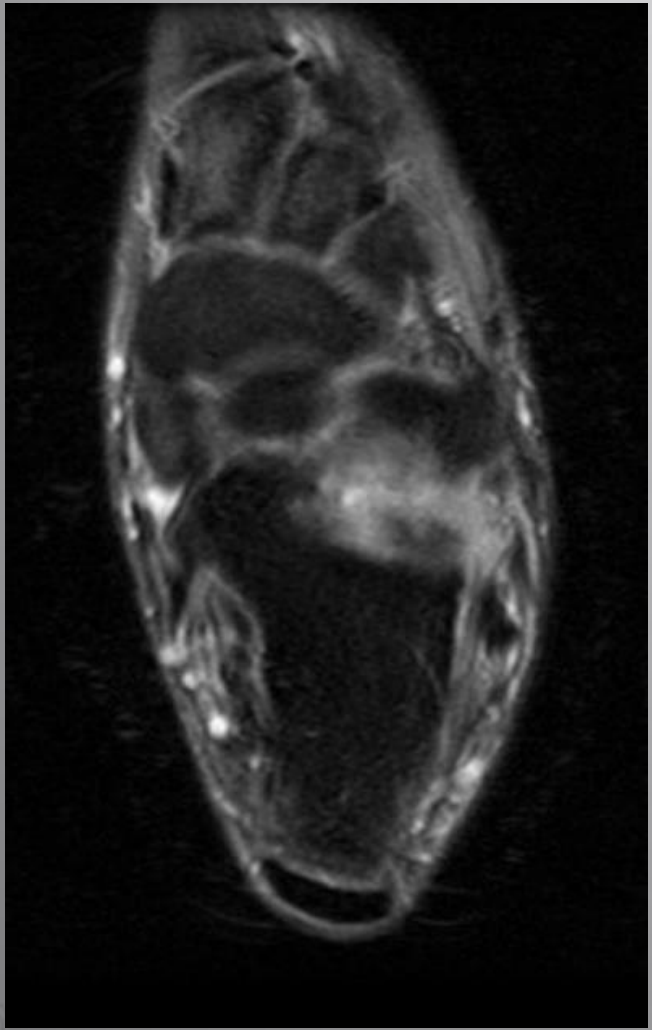
- Located in tendons that wrap around bony or fibrous pulleys
  - Peroneus longus tendon
  - Posterior tibialis tendon
- Adaptation to help maintain tendon structure
  - Resists compression or shear
  - Fibrous tissue
    - Flexibility
    - Toughness
  - Cartilaginous tissue
    - Elasticity
- Can alter tendon appearance on MR

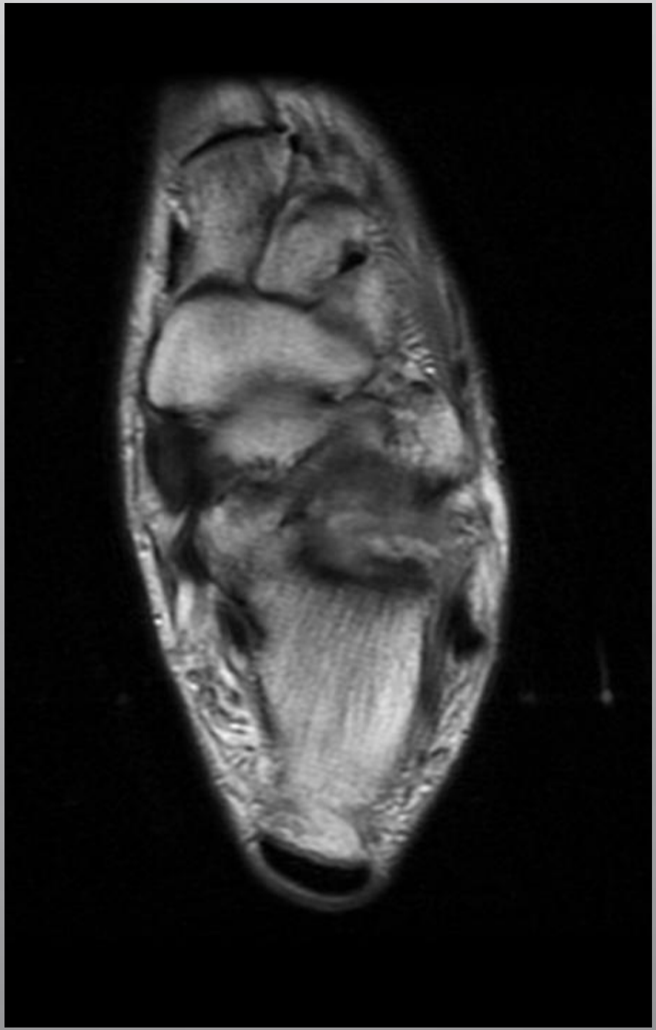
Peroneus Longus Tendon Fibrocartilaginous Sesamoid

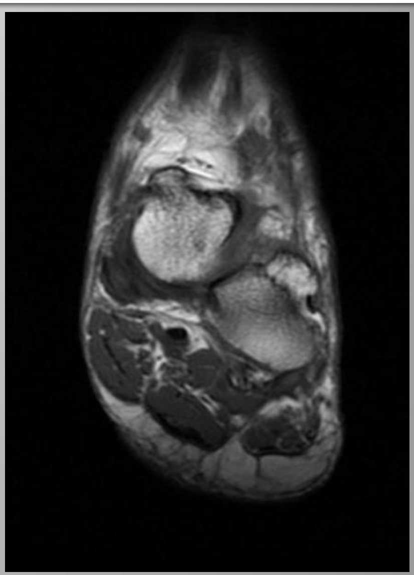


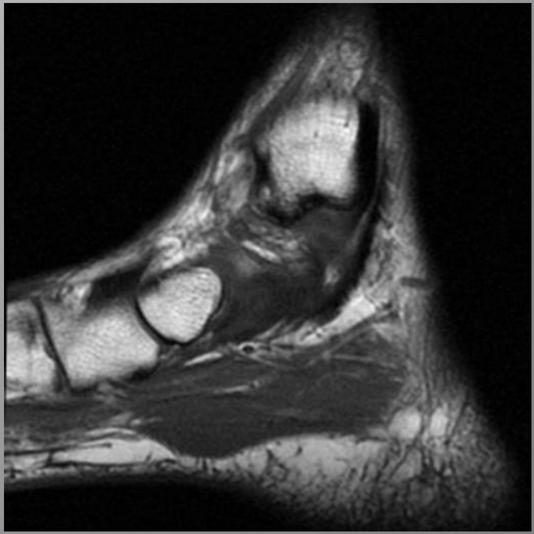
Didolkar MM, Malone AL, Nunley JA, et al. Pseudotear of the peroneus longus tendon on MRI, secondary to a fibrocartilaginous node. Skeletal Radiol 2012; 41:1419-1425.

Posterior Tibialis Tendon Fibrocartilaginous Sesamoid





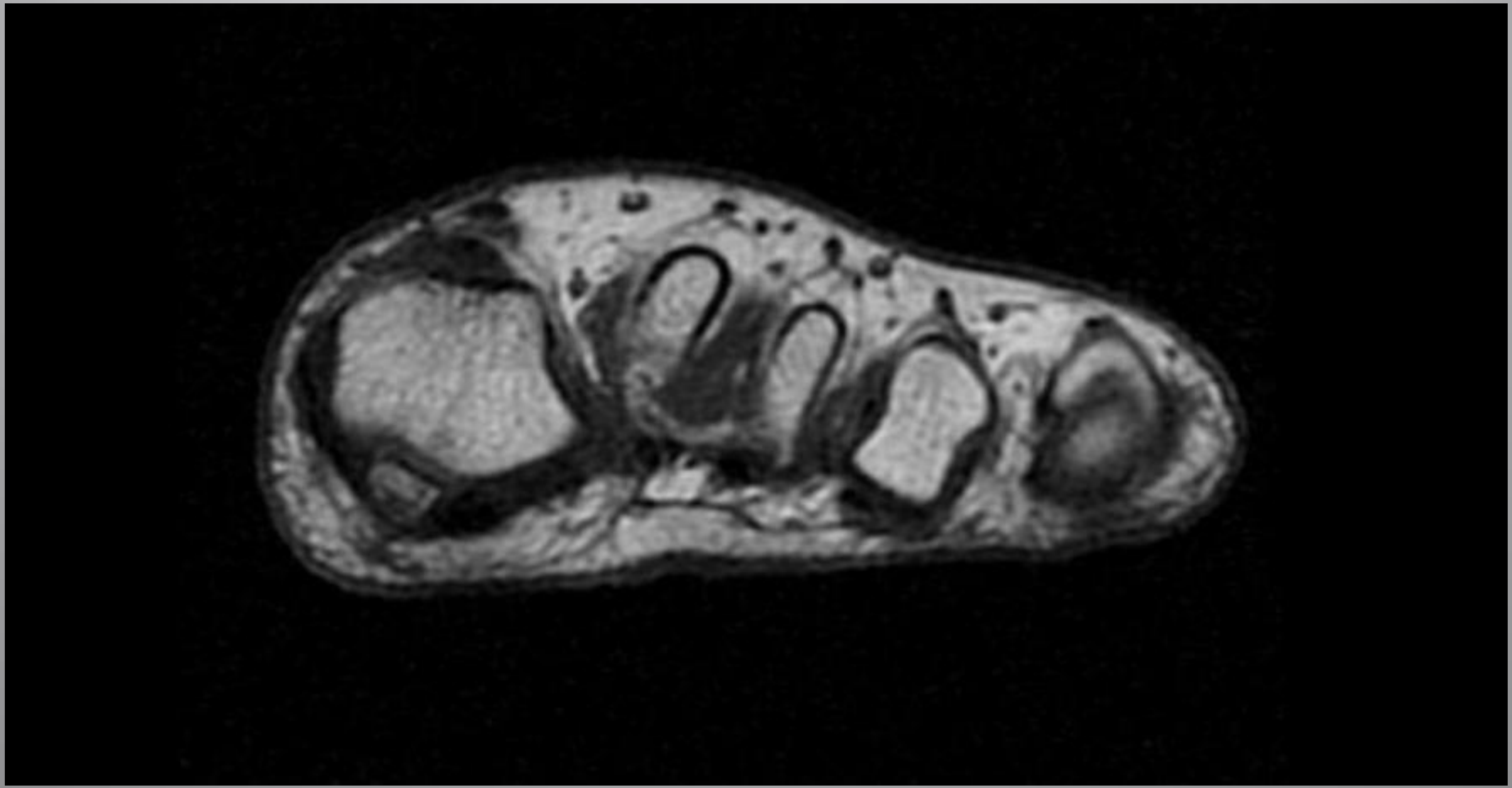




Sesamoid Development

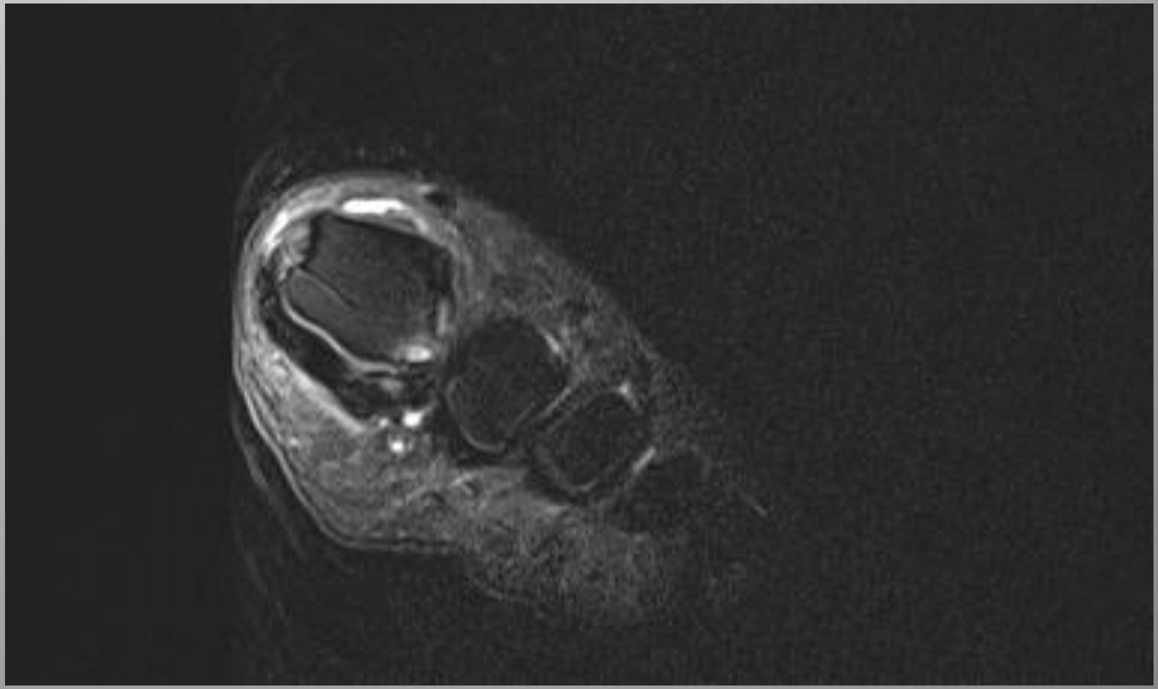
- Biological and mechanical factors
  - Skeletal geometry
  - Posture
  - Muscular activity
- Enchondral ossification
  - 1st MTP Joint: Precartilaginous tissue (10th week fetal life)➔chondrofication and integration into joint capsule (12 weeks)➔ossification (8th year)
- More numerous in fetus than in adult
  - Physical necessities probably play role in degree of development

Absent Fibular Hallux Sesamoid

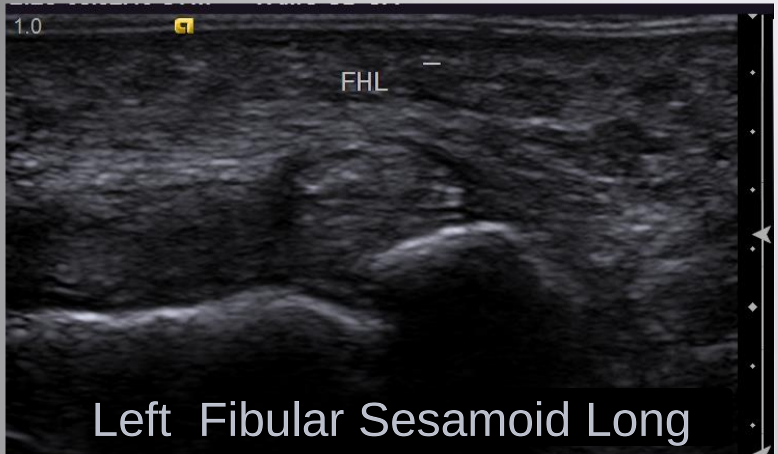


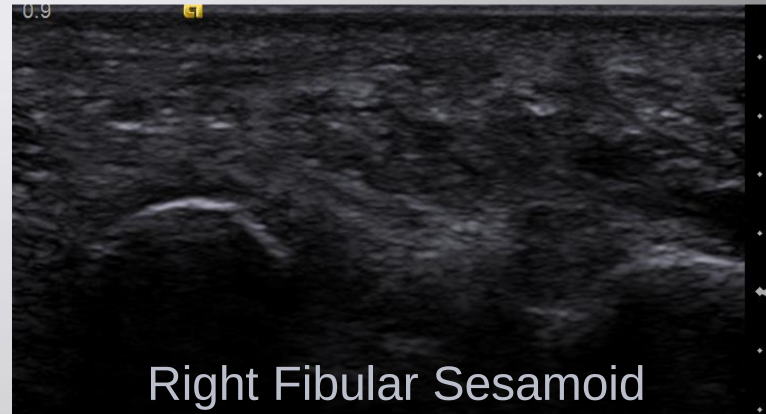
Courtesy of Dr. Mehdi Jalili

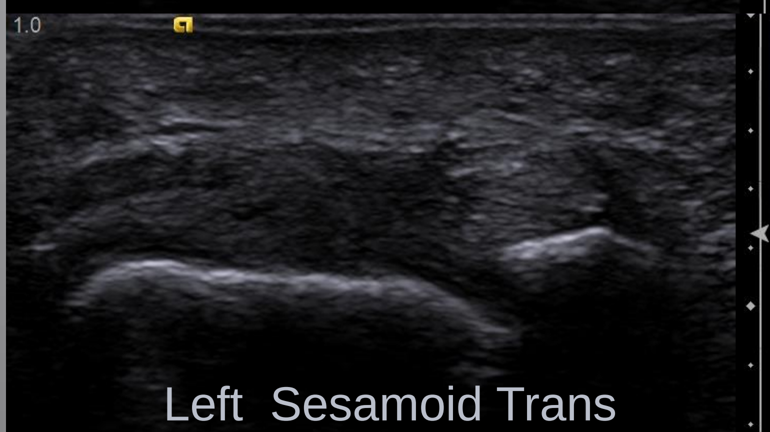
Absent Tibial Hallux Sesamoid



Courtesy of Dr. Karen Chen







Courtesy of Dr. Karen Chen

Pathophysiology

- Trauma
  - Acute fractures
  - Stress fracture
  - Dislocation
  - Sesamoiditis
- Infection
  - Osteomyelitis
  - Septic arthritis
- Arthritis
  - Osteoarthritis
  - Rheumatoid arthritis
  - Rheumatoid variants
    - Psoriasis, reactive arthritis, ankylosing spondylitis

Fractured Medial Hallucal Sesamoid Versus Bipartite Medial Sesamoid

Single medial sesamoid with fracture

- Fractured sesamoid *slightly larger* than lateral
- Sharp, radiolucent, uncorticated line
- Fragments fit together like puzzle pieces
- Increased uptake on 99mTc-MDP bone scan
- Marrow edema in recent fracture

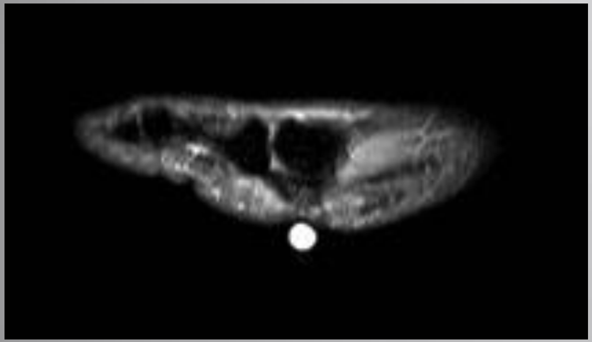
Bipartite medial sesamoid

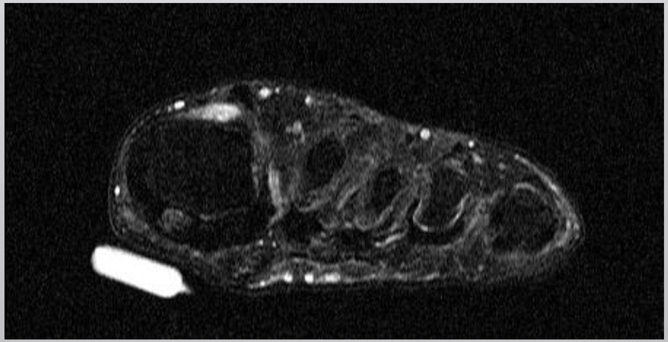
- *Much larger* medial sesamoid than lateral
- Two corticated components
- Two components do not fit together like puzzle
- No increased uptake on 99mTc-MDP bone scan
- No marrow edema

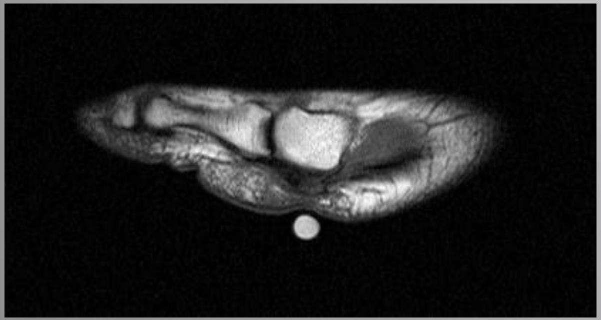
Sesamoid Fracture

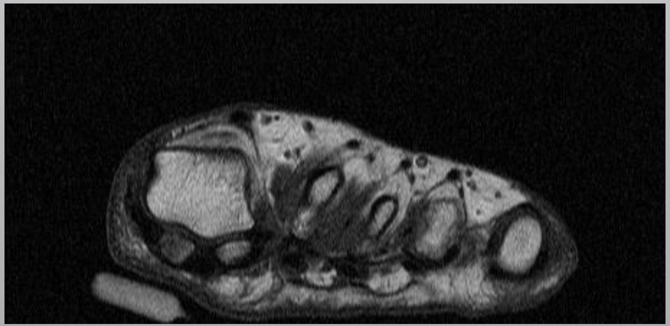
Courtesy of Dr. Brady Huang

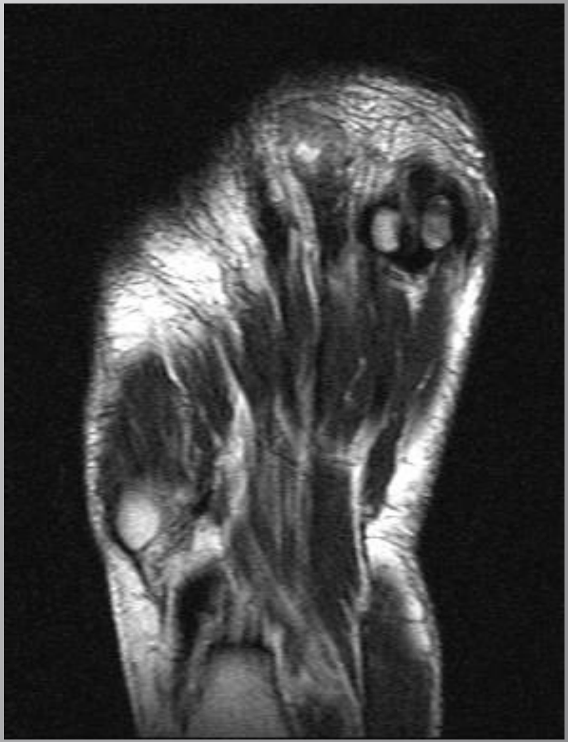
Sesamoid Fracture











Courtesy of Dr. Brady Huang

Sesamoid Fracture

2/6/2014

tte

Prior 5/18/2007

Courtesy of Dr. Brady Huang

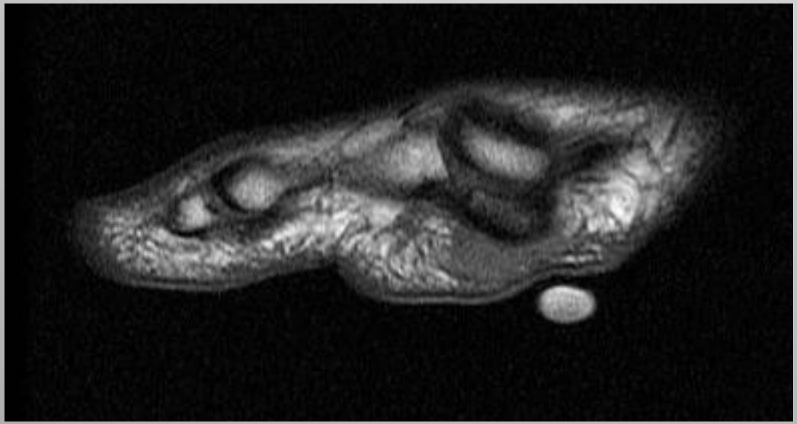
Sesamoid Fracture

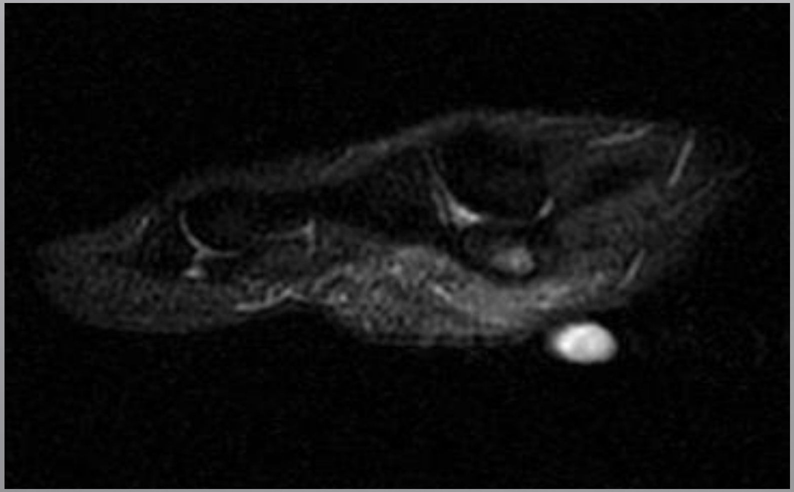
Courtesy of Dr. Brady Huang

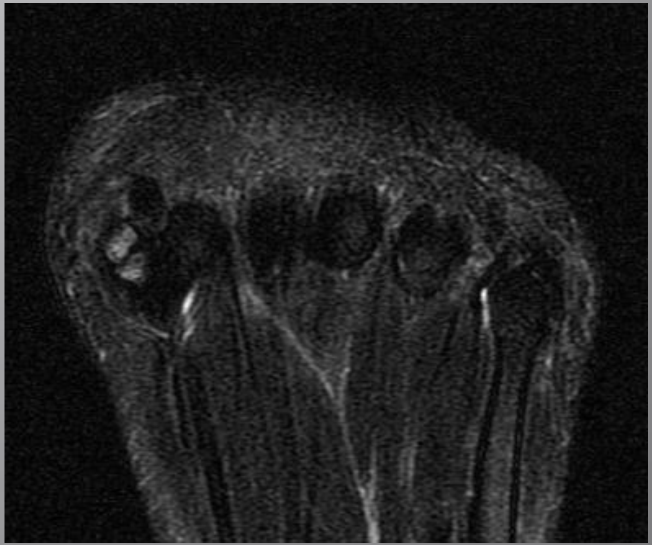
Sesamoiditis

- Chronic stress→painful conditions
- Most common associations
  - Stress fracture
  - Stress reaction
  - Osteoarthritis
  - Osteonecrosis
- Imaging
  - 99mTc-MDP bone scan: Focal increased uptake
  - MR: Marrow edema in both sesamoiditis and osteonecrosis
    - CT: Subtly increased sclerosis in osteonecrosis

Sesamoiditis

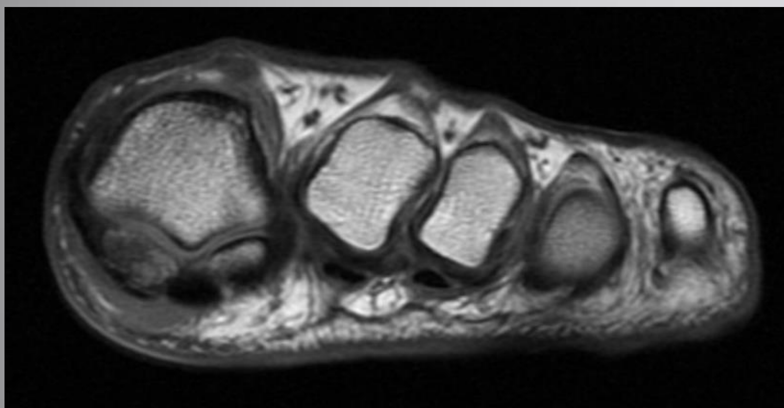


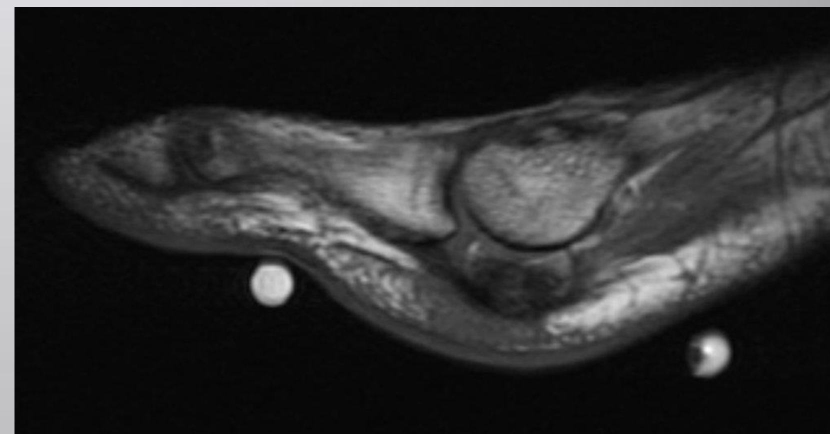


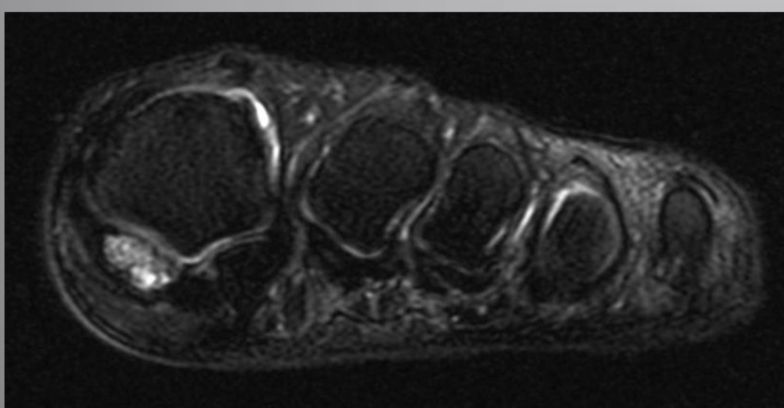


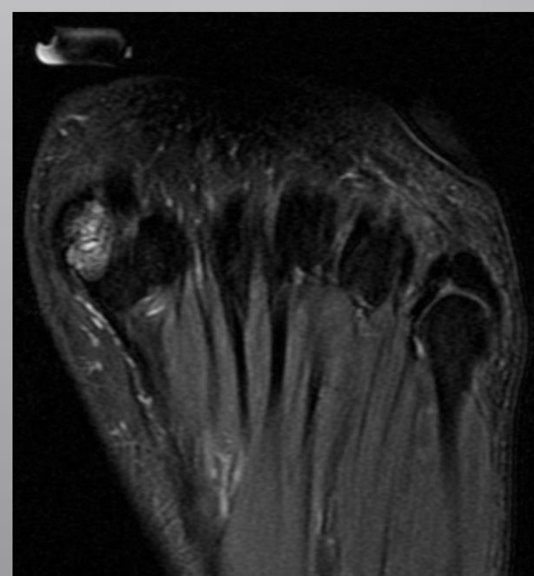
Courtesy of Dr. Brady Huang

Sesamoiditis







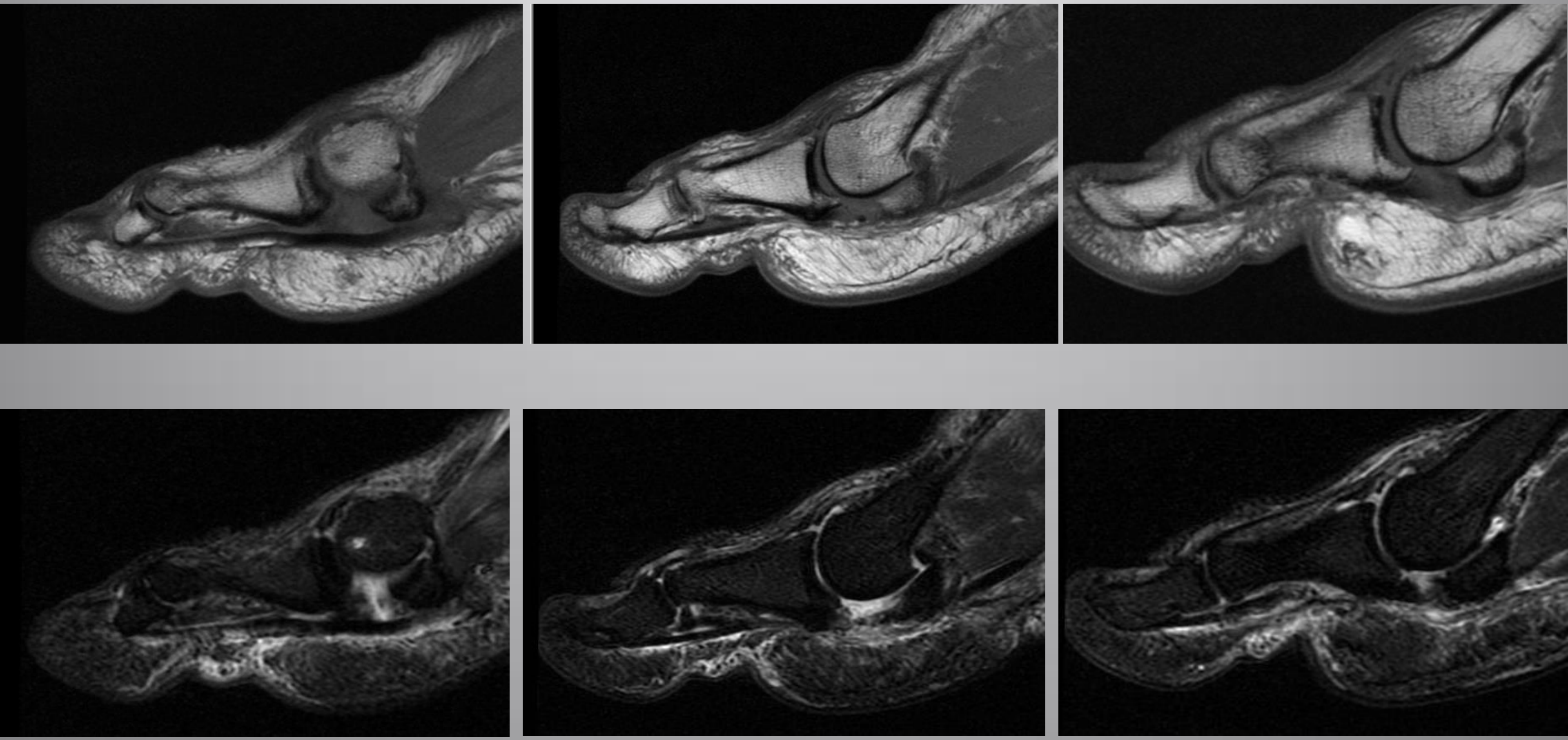


Courtesy of Dr. Mini Pathria

Dislocation

- Diagnosed by displacement
- Negative 99mTc-MDP bone scan
- Turf toe
  - Severe hyperextension injury of MTP joint
    - Rupture of plantar capsule
    - Injury of flexor hallucis brevis tendon
    - Sometimes transverse fracture and separation of one or both sesamoid bones

Turf Toe



Courtesy of Dr. Mini Pathria

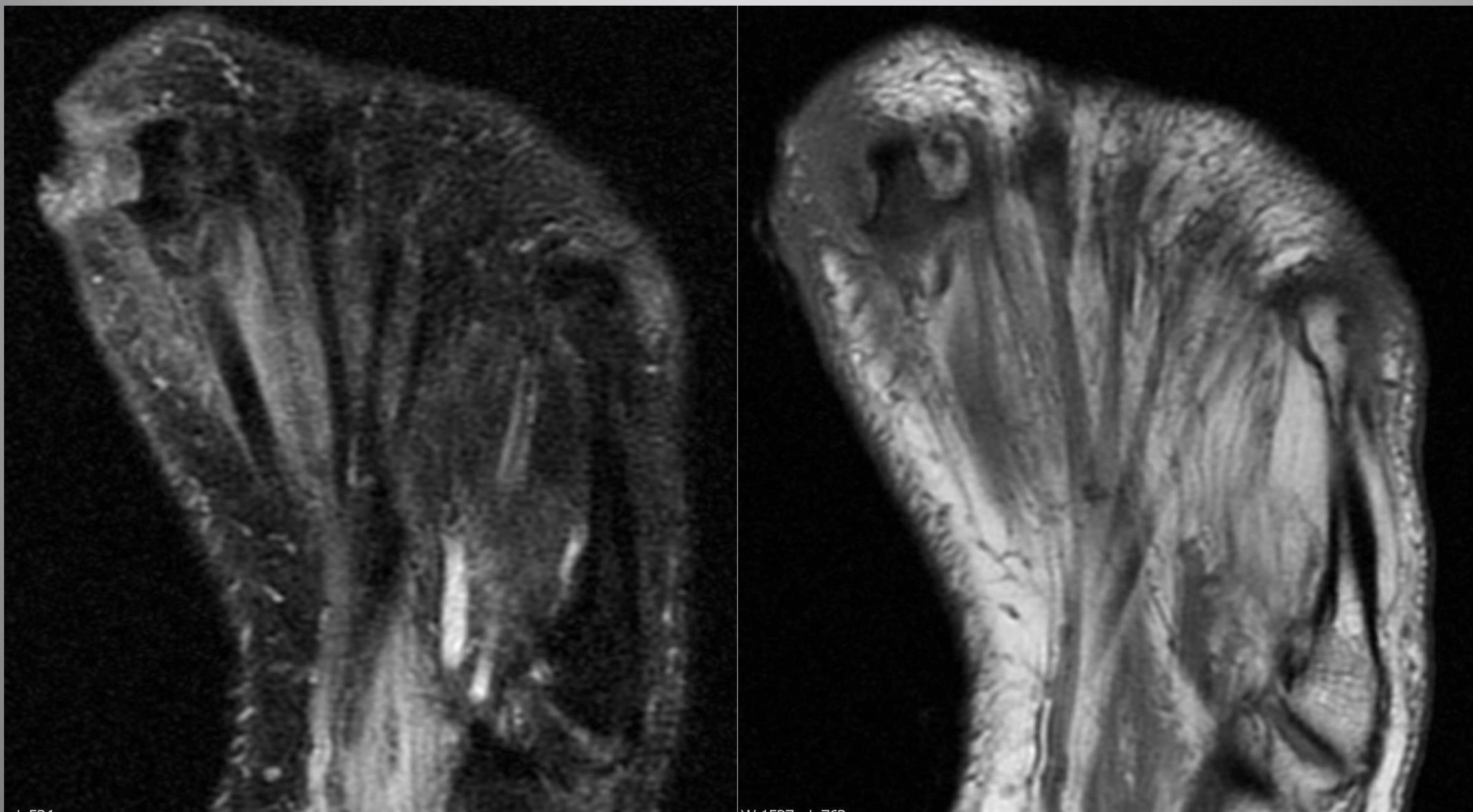
Turf Toe

Infection

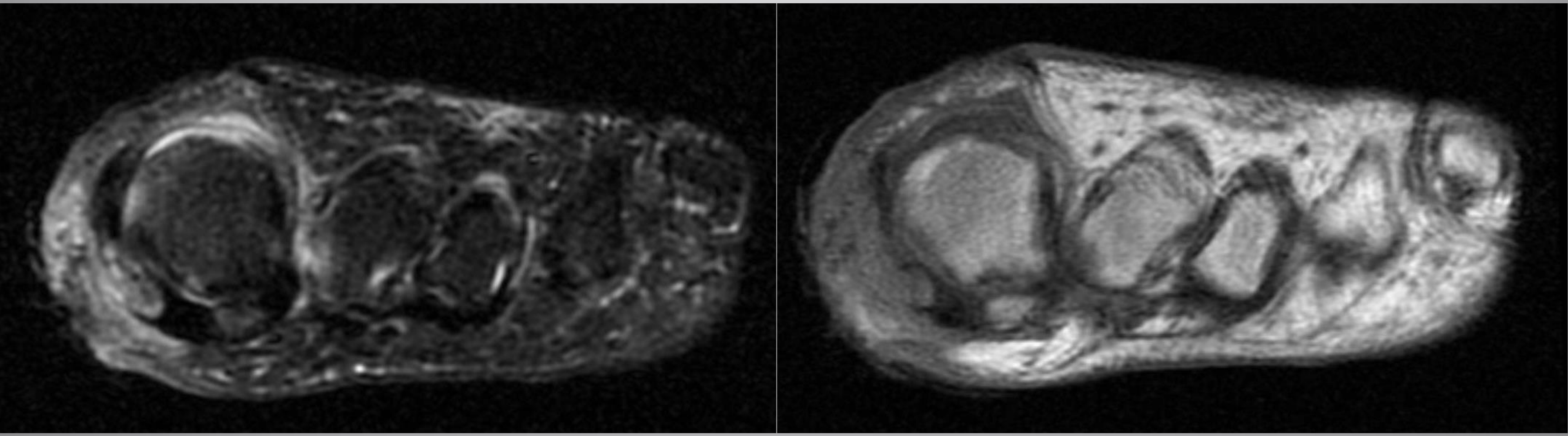
- Radiographs
  - Fragmentation
  - Resorption
  - Subluxation
- MRI
  - T1 low signal
  - T2 high signal
  - Enhancement
- Bone scintigraphy
  - Increased activity

Infection

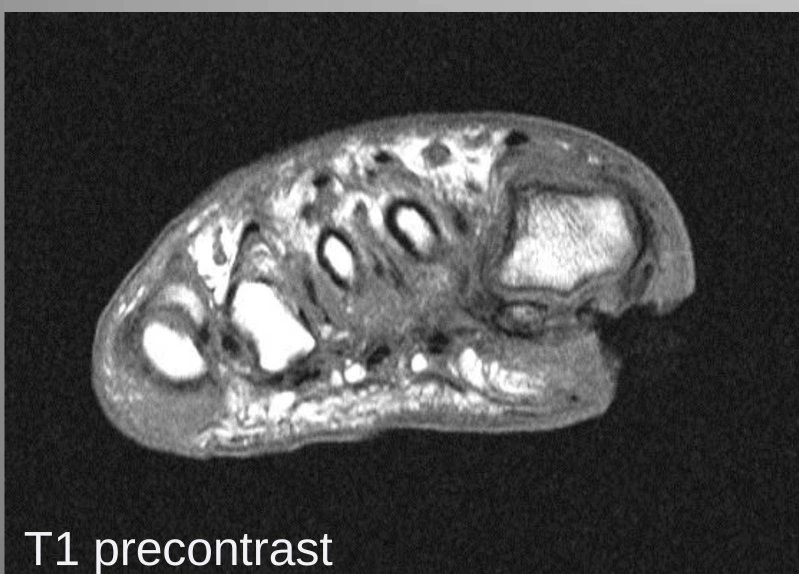
Infection



Infection



Infection



Courtesy of Dr. Mini Pathria

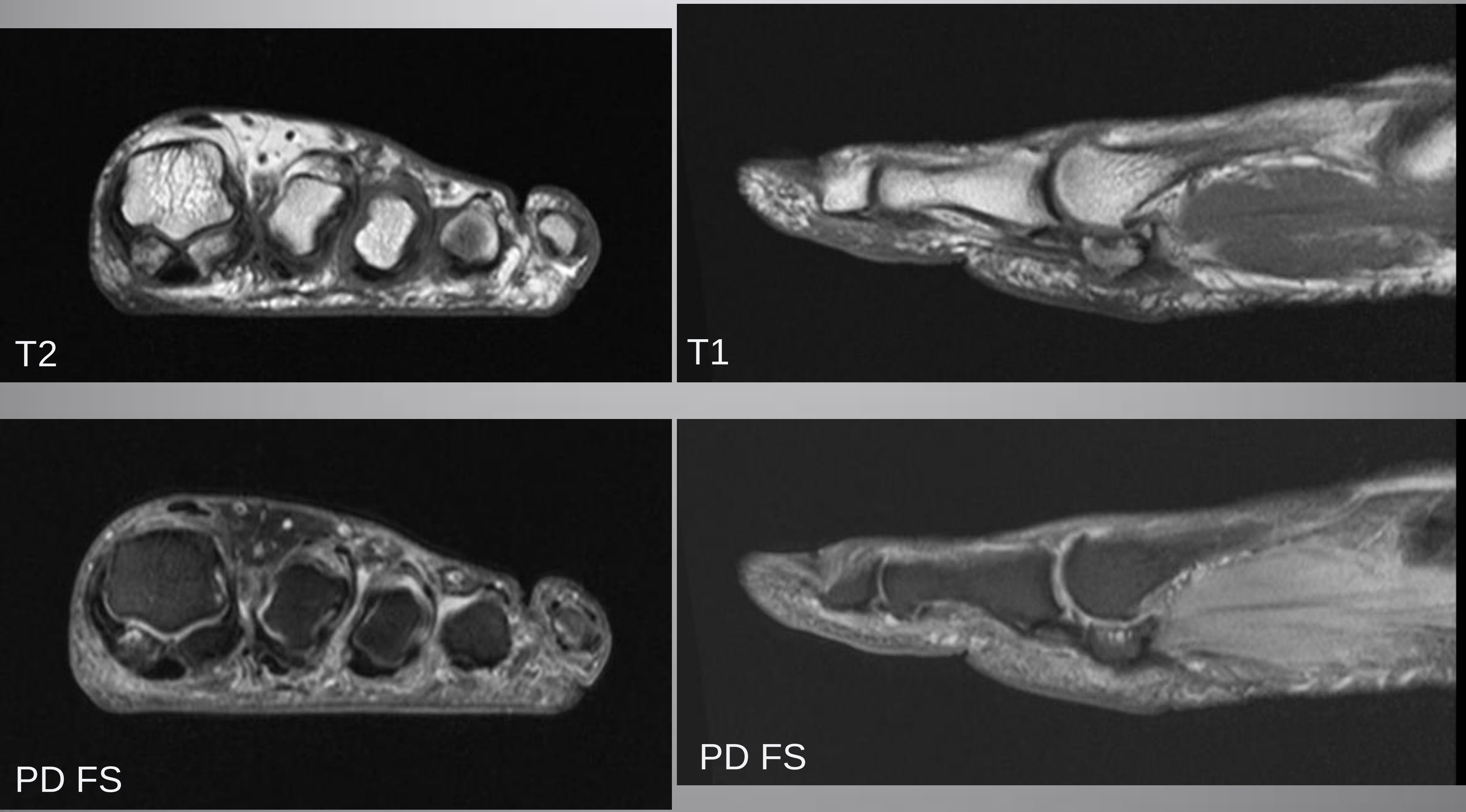
Infection

Courtesy of Dr. Mini Pathria

Osteoarthritis

- Radiographs
  - Nonuniform joint space loss
  - Osteophyte formation
  - Bony eburnation
  - Flattening of portion of sesamoid
- CT
  - Sclerosis and fragmentation
- MRI
  - Marrow and soft tissue changes

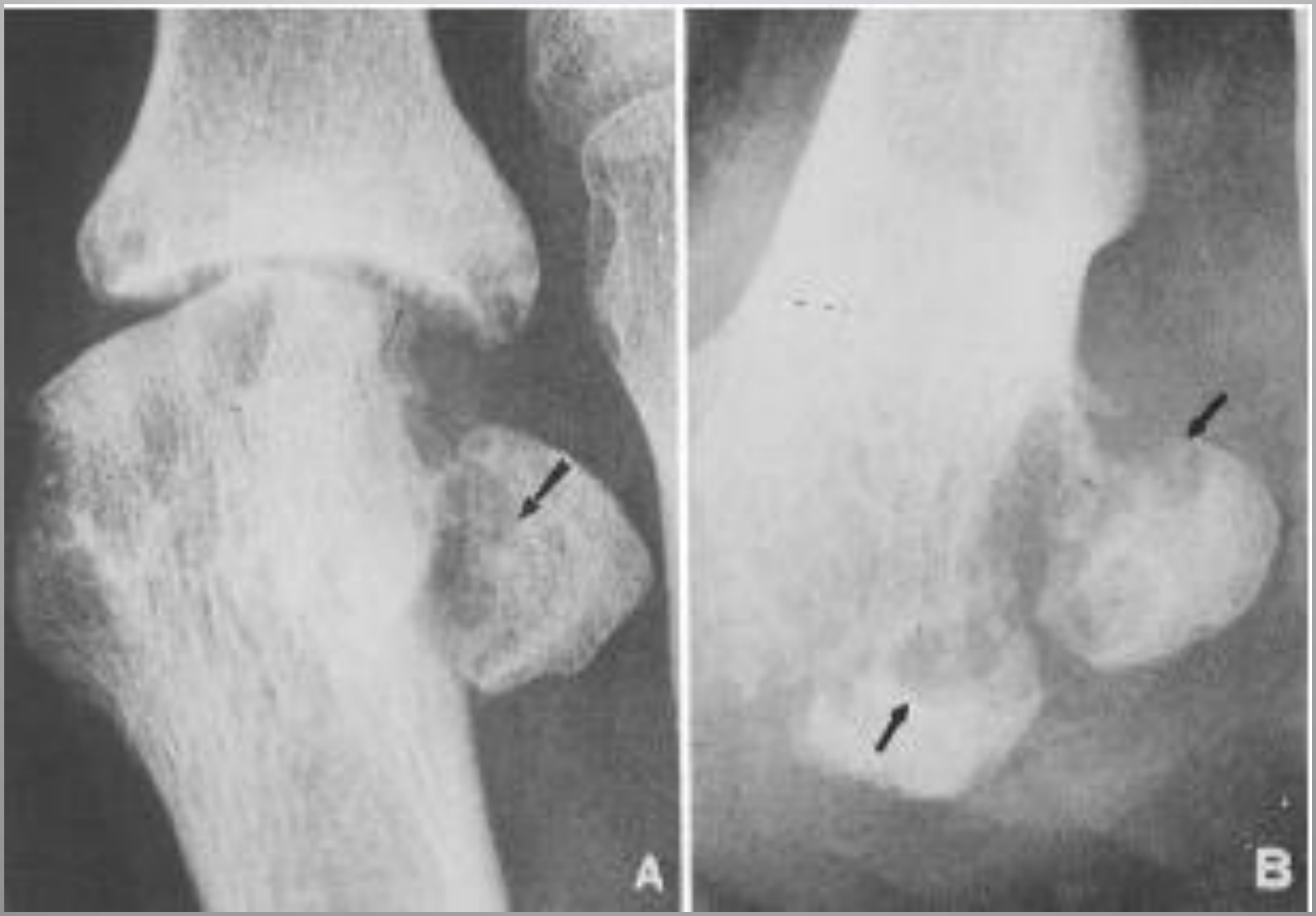
Osteoarthritis



Rheumatoid Arthritis

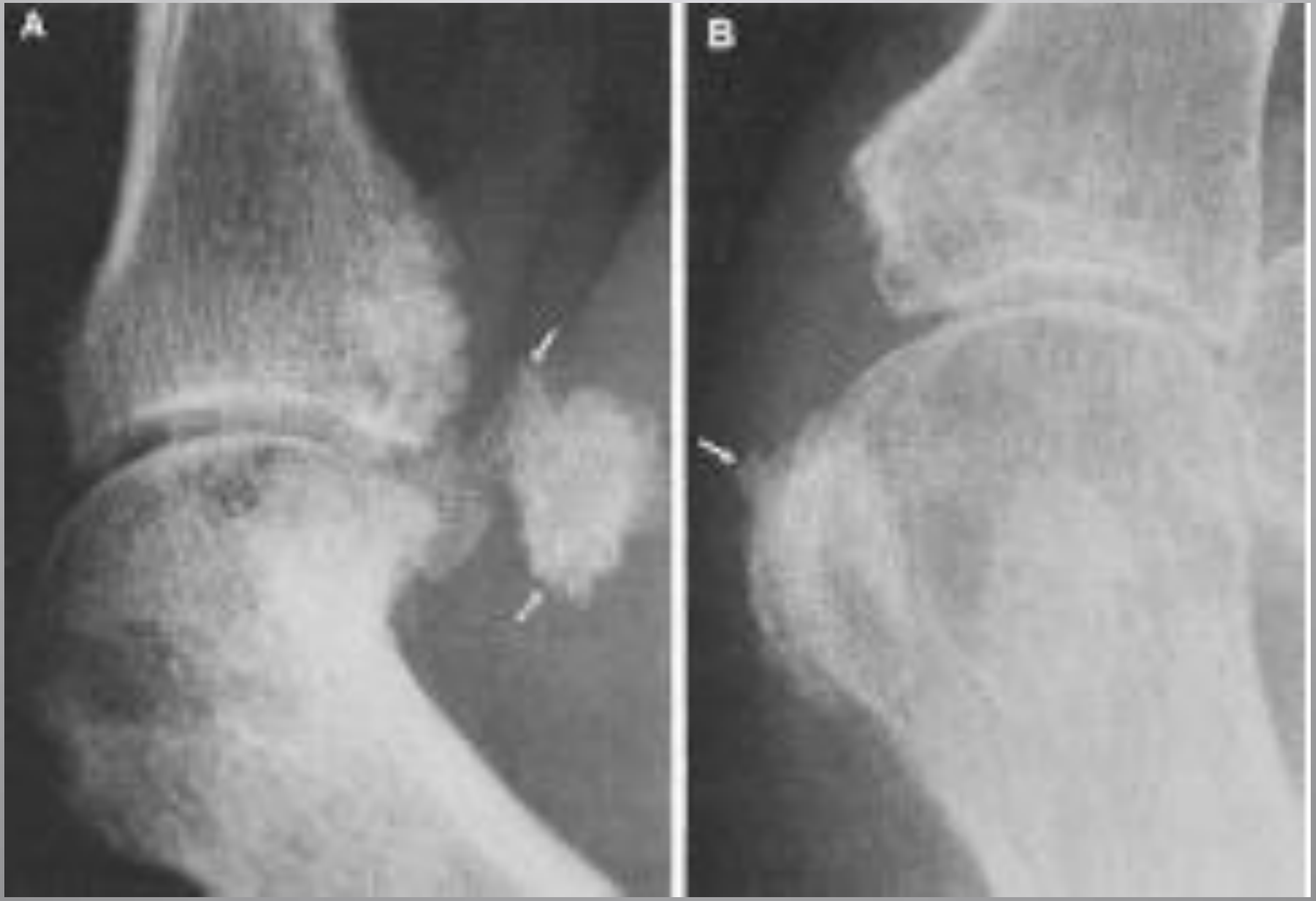
- Synovial membrane inflammation→pannus→cartilage and subchondral bone destruction
- Adjacent tendonitis and tenosynovitis→surface resorption→additional sesamoid destruction
- Radiographs
  - Bone resorption and erosions
  - Uniform joint-space loss
  - Soft tissue swelling
- Rheumatoid variants: Sesamoid “periostitis”

Rheumatoid Arthritis



Resnick D, Niwayama G, Feingold ML. The sesamoid bones of the hands and feet: participators in arthritis. Radiology 1977; 123:57-62.

Reactive Arthritis/Ankylosing Spondylitis

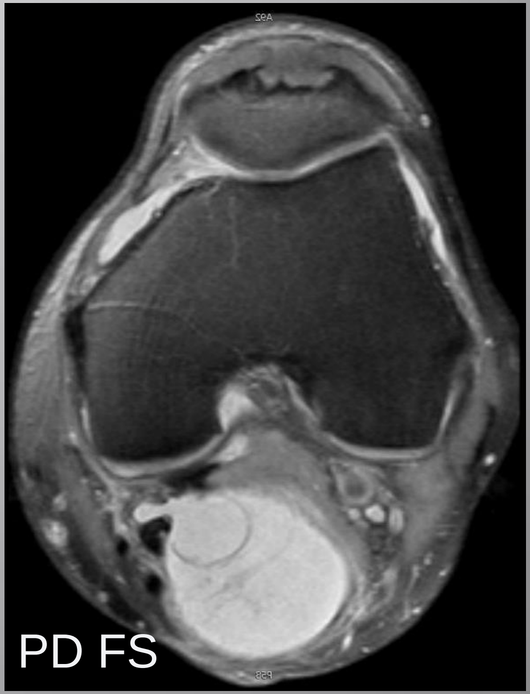


Resnick D, Niwayama G, Feingold ML. The sesamoid bones of the hands and feet: participators in arthritis. Radiology 1977; 123:57-62.

Crystal Deposition Disease

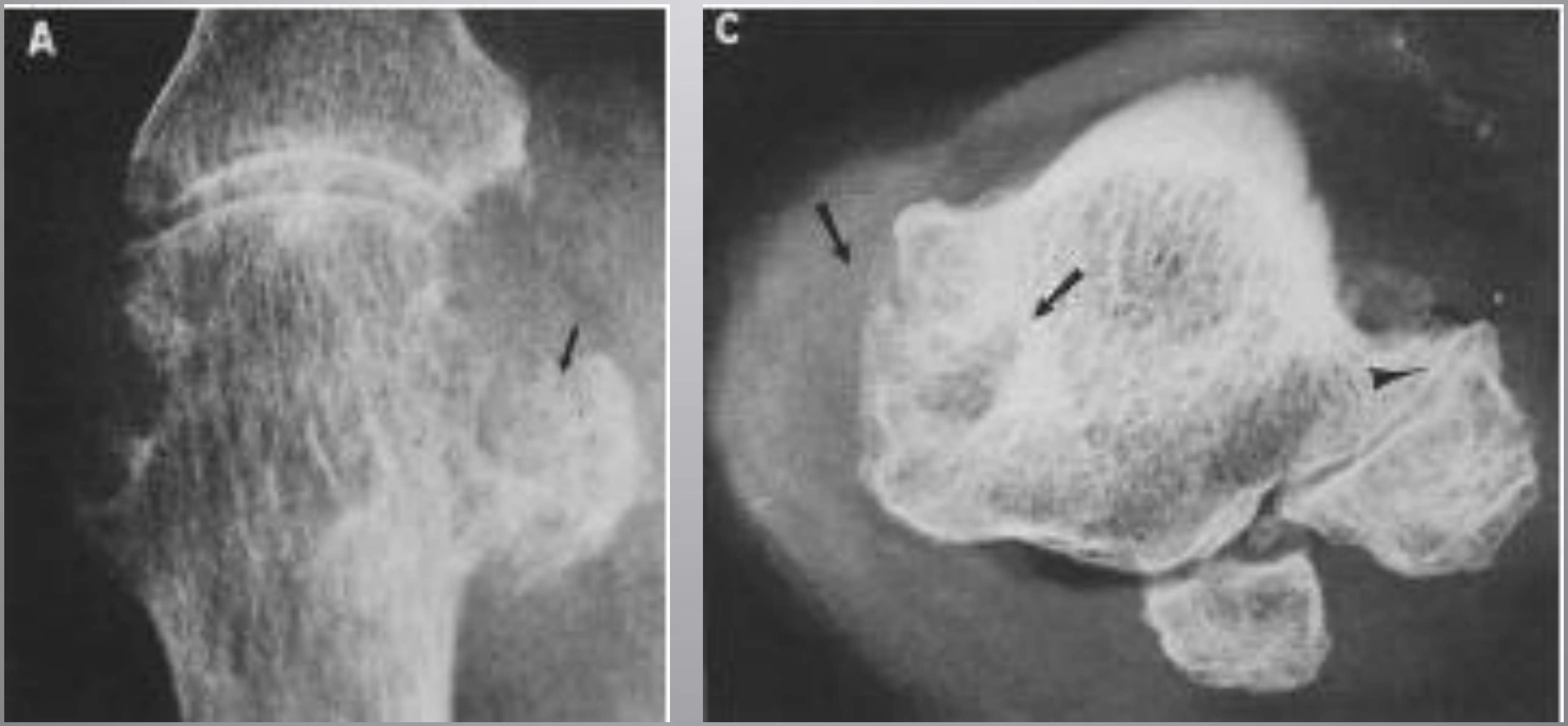
- Crystal deposition within cartilage and bone
  - Gout
    - Erosions
  - CPPD
    - Cystic changes
    - Sclerosis
    - Chondrocalcinosis
- Diagnosis
  - Joint aspiration and crystal evaluation

Gout



Courtesy of Dr. Mini Pathria

Gout



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Painful Os Peroneum Syndrome (POPS)

- Cause of plantar lateral foot pain
- Acute or chronic presentations
  - Acute: Sudden trauma (ankle supination and/or inversion injury)
  - Chronic: Repetitive injuries
- POPS spectrum
  - Acute os peroneum fracture or diastasis of a multipartite os peroneum
  - Chronic os peroneum fracture or diastasis of a multipartite os peroneum
  - Attrition or partial rupture of the peroneus longus tendon
  - Frank rupture of the peroneus longus tendon with discontinuity proximal or distal to the os peroneum
  - Presence of a gigantic peroneal tubercle which entraps the peroneus longus tendon and/or the os peroneum during tendon excursion

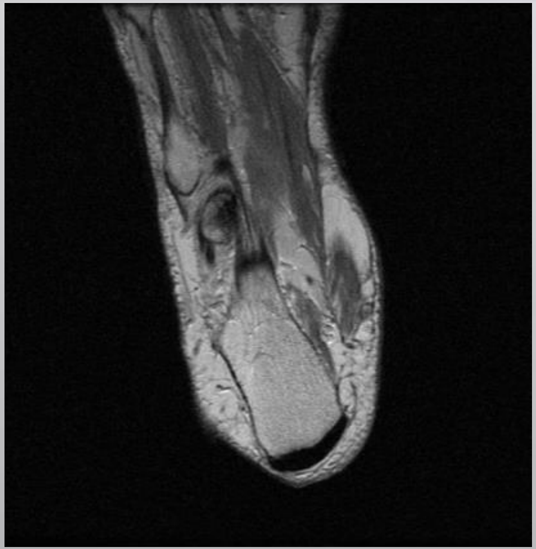
Painful Os Peroneum Syndrome

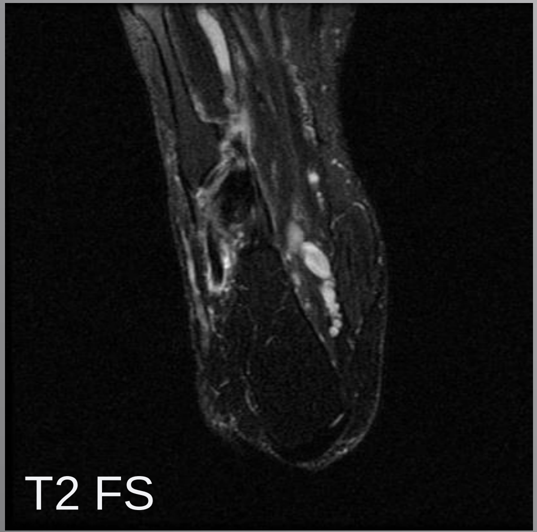
12/28/2010

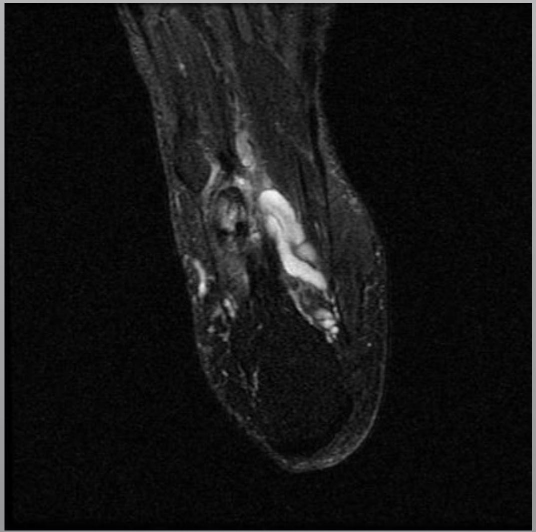
Prior 2/2/2010

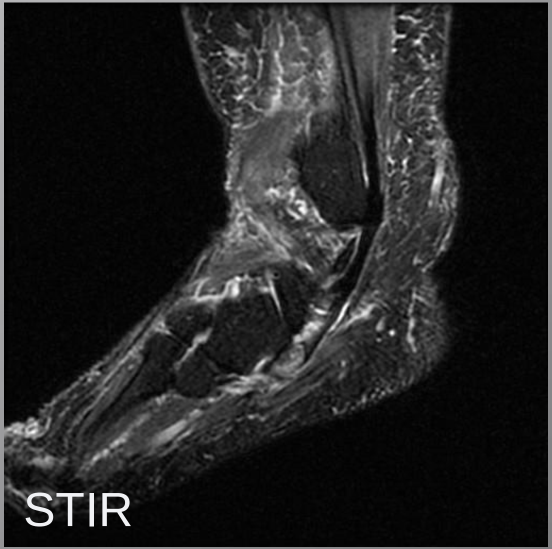
Courtesy of Dr. Brady Huang

Painful Os Peroneum Syndrome



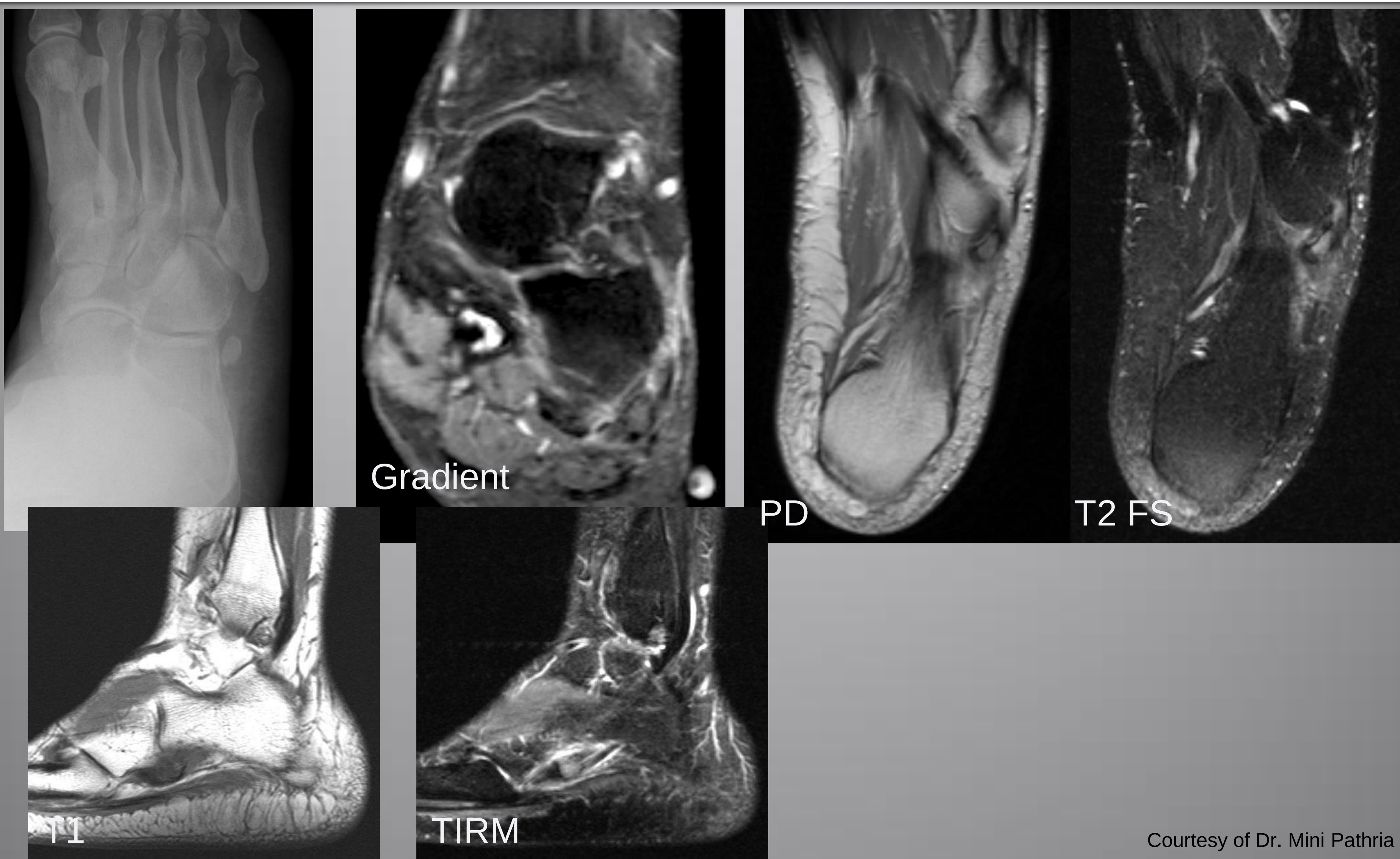






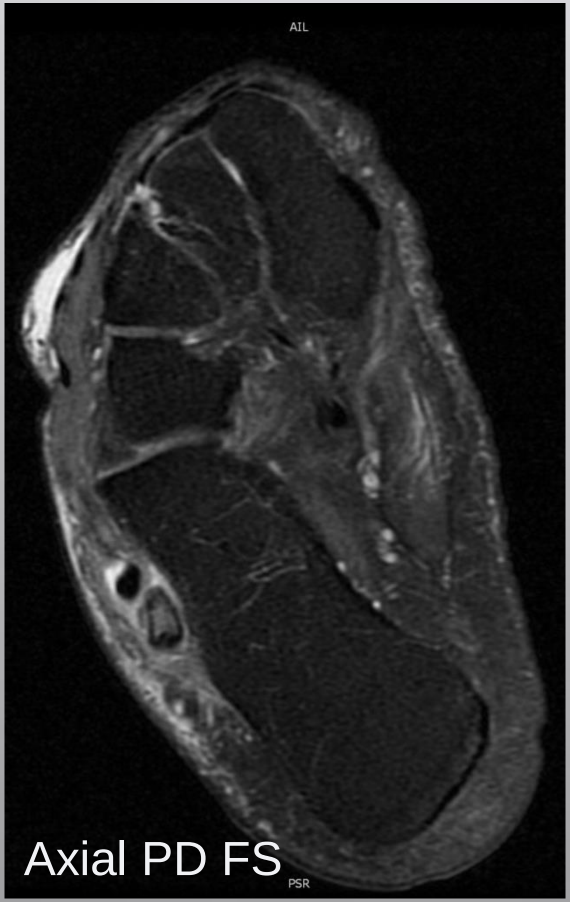
Courtesy of Dr. Brady Huang

Painful Os Peroneum Syndrome



Courtesy of Dr. Mini Pathria

Displaced Os Peroneum

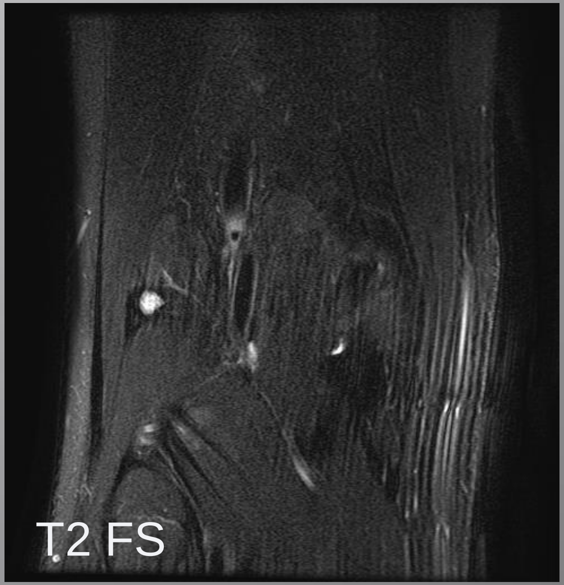


Courtesy of Dr. Thao Wagner and Dr. Mini Pathria

Fabella Syndrome

- Cause of posterolateral knee pain
  - Intermittent
  - Worsened by direct pressure over fabella
- Possible sources of pain
  - Compressive or tensile forces on the fabellofibular ligament
  - Compressive irritation of gastrocnemius tendon
  - Compression of fabella onto femoral condlye
  - Compression of posterior capsule by fabella
  - Compression of common fibular nerve between fabella and fibular head

Fabella Syndrome



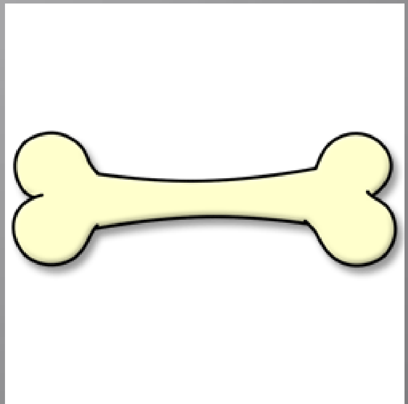
Courtesy of Dr. Brady Huang

Accessory Ossicles

- Normal anatomic variants
- Derived from unfused primary or secondary ossification centers
- No known function
  - Versus sesamoid bones which protect and sometimes increase efficacy

Accessory Ossicles

- Wizard of
  - os
    - **Bone**
    - A mouth or orifice of the body
  - OS
    - Old Saxon
    - Operating System
  - Os
    - Osmium
  - O.S.
    - The left eye (in prescriptions)
    - Old series
    - Ordinary seaman



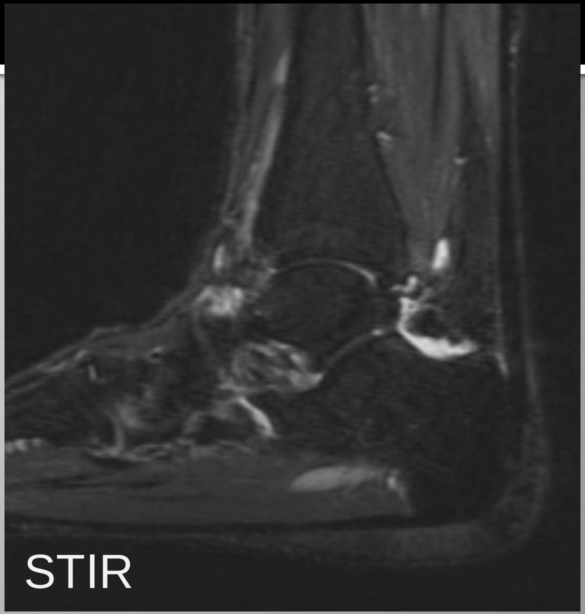
Accessory Ossicles

- Similarities with sesamoid bones
  - Small, well-corticated, round or ovoid shape
  - May be bipartite or multipartite
  - Found close to bone or joint
  - May be unilateral or bilateral
  - Subject to morphological variations
  - Can undergo pathologic changes→symptomatic

Os Trigonum

- Located posterior to talus
- Failure of fusion of ossification center (7%)
- Corticated
- Articulates with lateral tubercle of posterior process

Os Trigonum



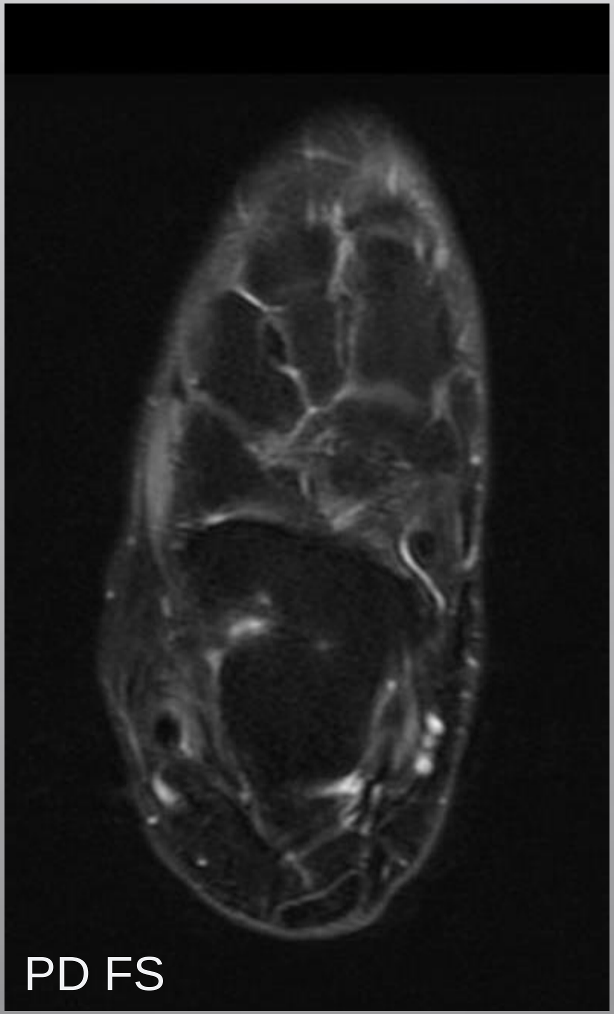
Os Trigonum Syndrome

Courtesy of Dr. Justin Tan

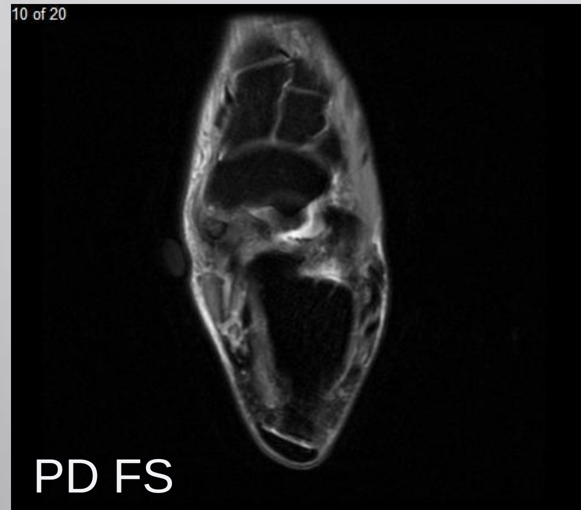
Accessory Navicular Bone

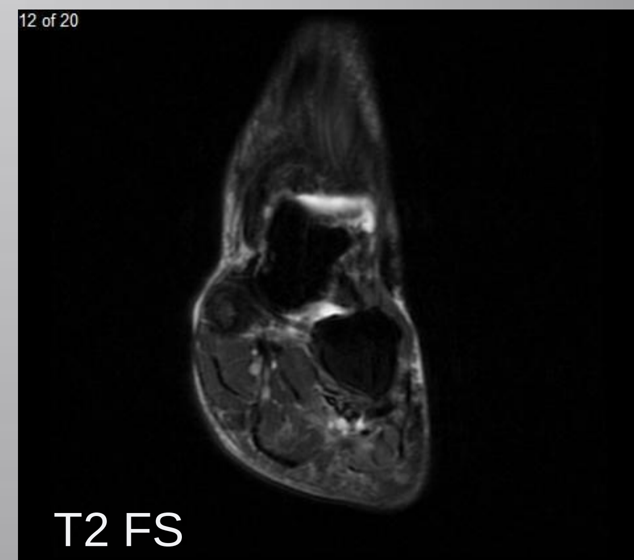
- Located adjacent to posteromedial tuberosity of navicular bone
- Three types
  - Type I: Os tibiale externum
    - Sesamoid bone within the tibialis posterior tendon
    - Separated up to 5 mm from navicular tuberosity
  - Type II: Os naviculare
    - Connected to navicular by cartilaginous synchondrosis
    - Separated from navicular by 1-2 mm
  - Type III: Cornuate navicular
    - Prominent navicular tuberosity
    - Essentially a fused type II accessory navicular bone

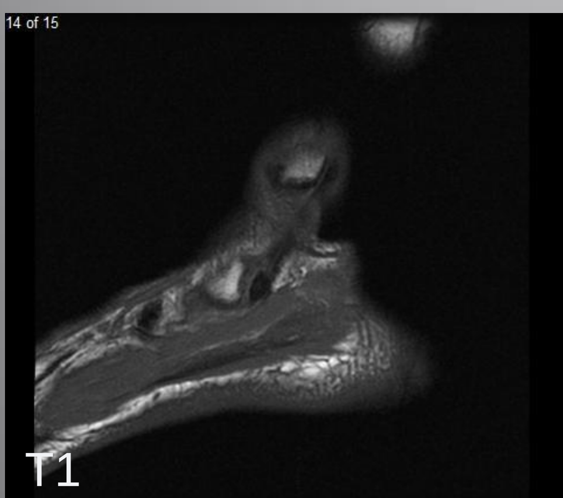
Type I Accessory Navicular (Os Tibiale Externum)

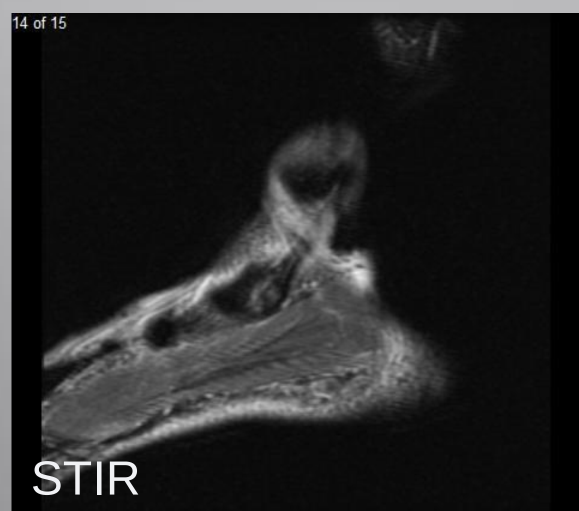


Edematous Os Tibiale Externum

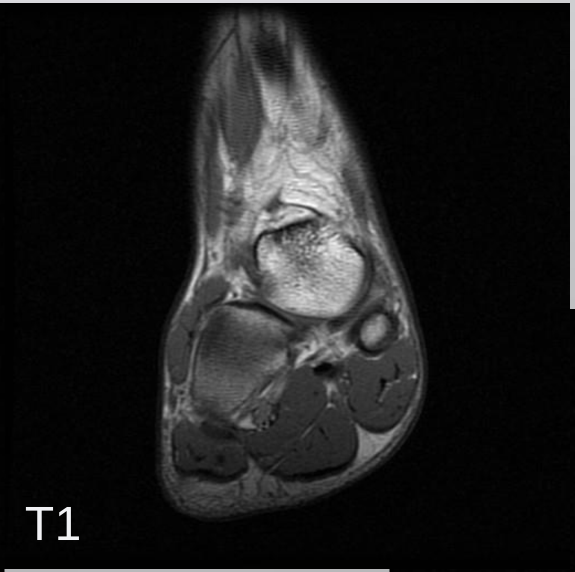






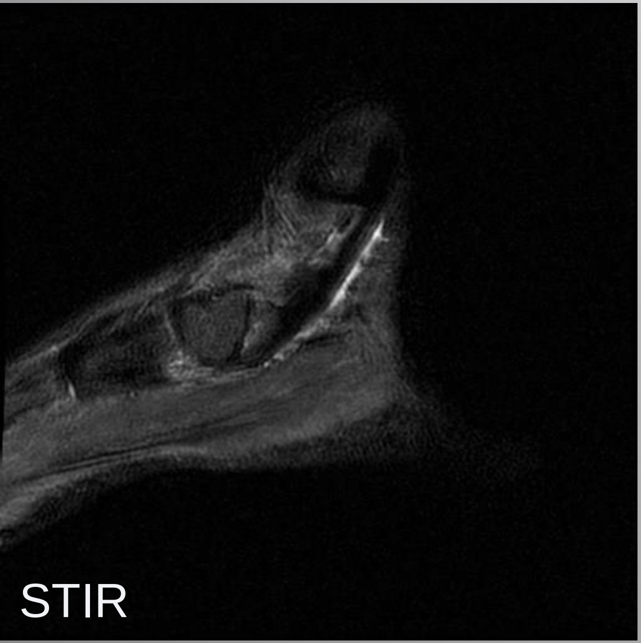


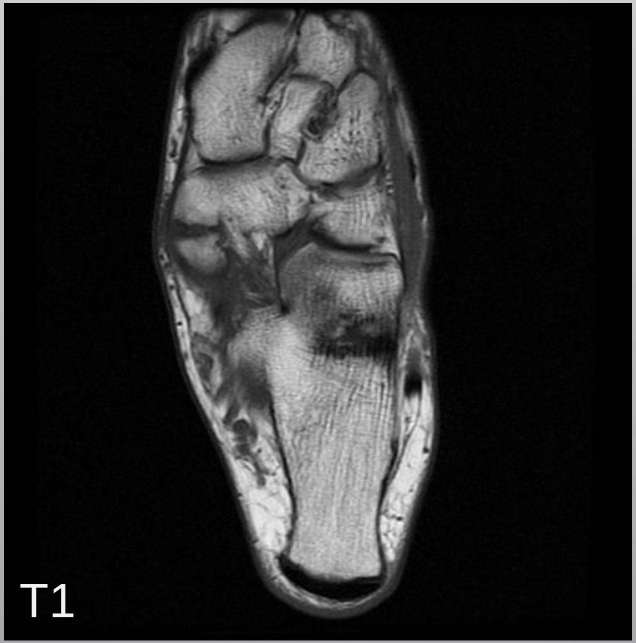
Type II Accessory Navicular (Os Naviculare)

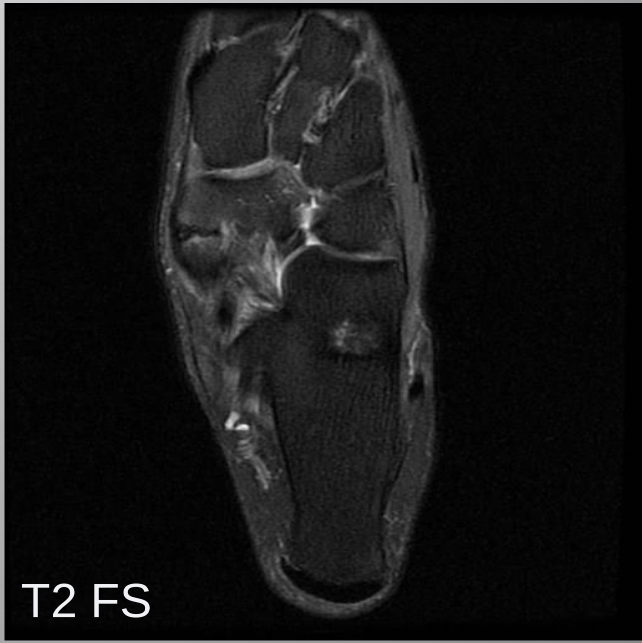


Courtesy of Dr. Brady Huang

Painful Accessory Os Naviculare

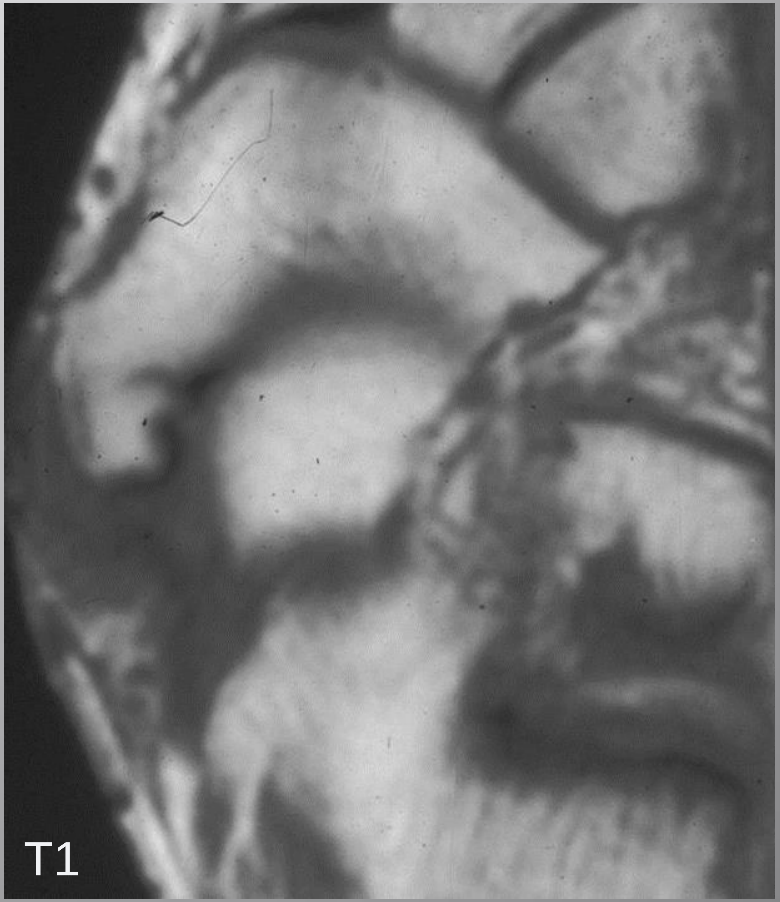






Courtesy of Dr. Brady Huang

Type III Accessory Navicular (Cornuate Navicular)



Courtesy of Dr. Donald Resnick

Os Intermetatarseum

- Located between medial cuneiform and base of 1^{st} and 2^{nd} metatarsals
- Often confused with fracture
- Rarely associated with pathology
- May cause dorsal midfoot pain
  - Compression of medial branch of deep peroneal nerve

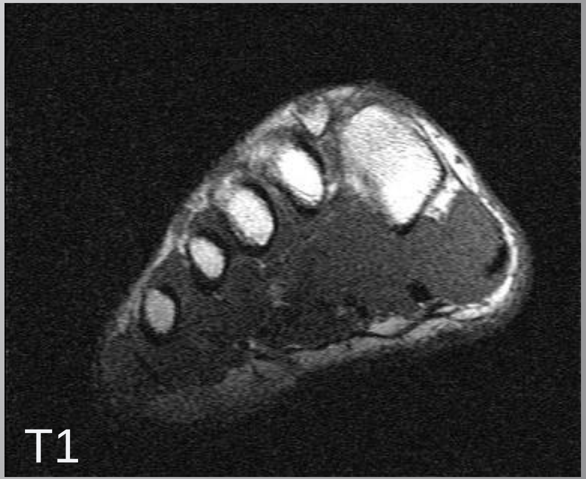
Os Intermetatarseum

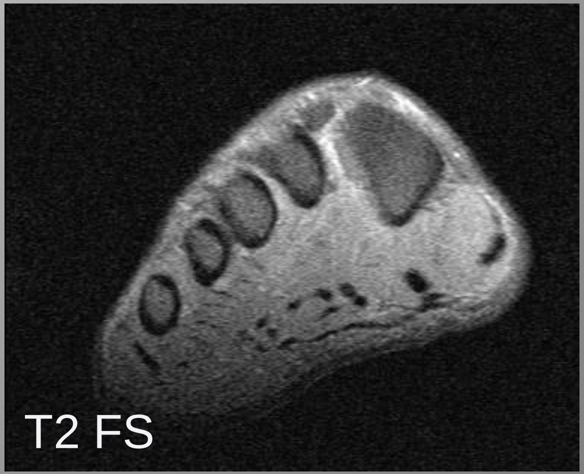
Courtesy of Dr. Brady Huang

Os Intermetatarseum

Courtesy of Dr. Brady Huang

Os Intermetatarseum





Courtesy of Dr. Brady Huang

Os Vesalianum

- Located proximal to base of 5^{th} metatarsal, within peroneus brevis tendon
- Rarely a source of pathology
- Should be differentiated from
  - Normal ossification center of tuberosity of fifth metatarsal
    - Parallel to metatarsal shaft
  - Avulsion fracture of fifth metatarsal apophysis
    - Usually lies in transverse plane

Os Vesalianum

Courtesy of Dr. Brady Huang

Os Vesalianum

Courtesy of Dr. Mina Zakhary

Os Supranaviculare

- Located at dorsal aspect of talonavicular joint
- Should be differentiated from cortical avulsion fracture of dorsal navicular
  - Typically thin sliver of bone
- Rarely symptomatic

Os Supranaviculare

Ingalls J, Wissman R. The os supranaviculare and navicular stress fracture. Skeletal Radiol 2011; 40:937-941.

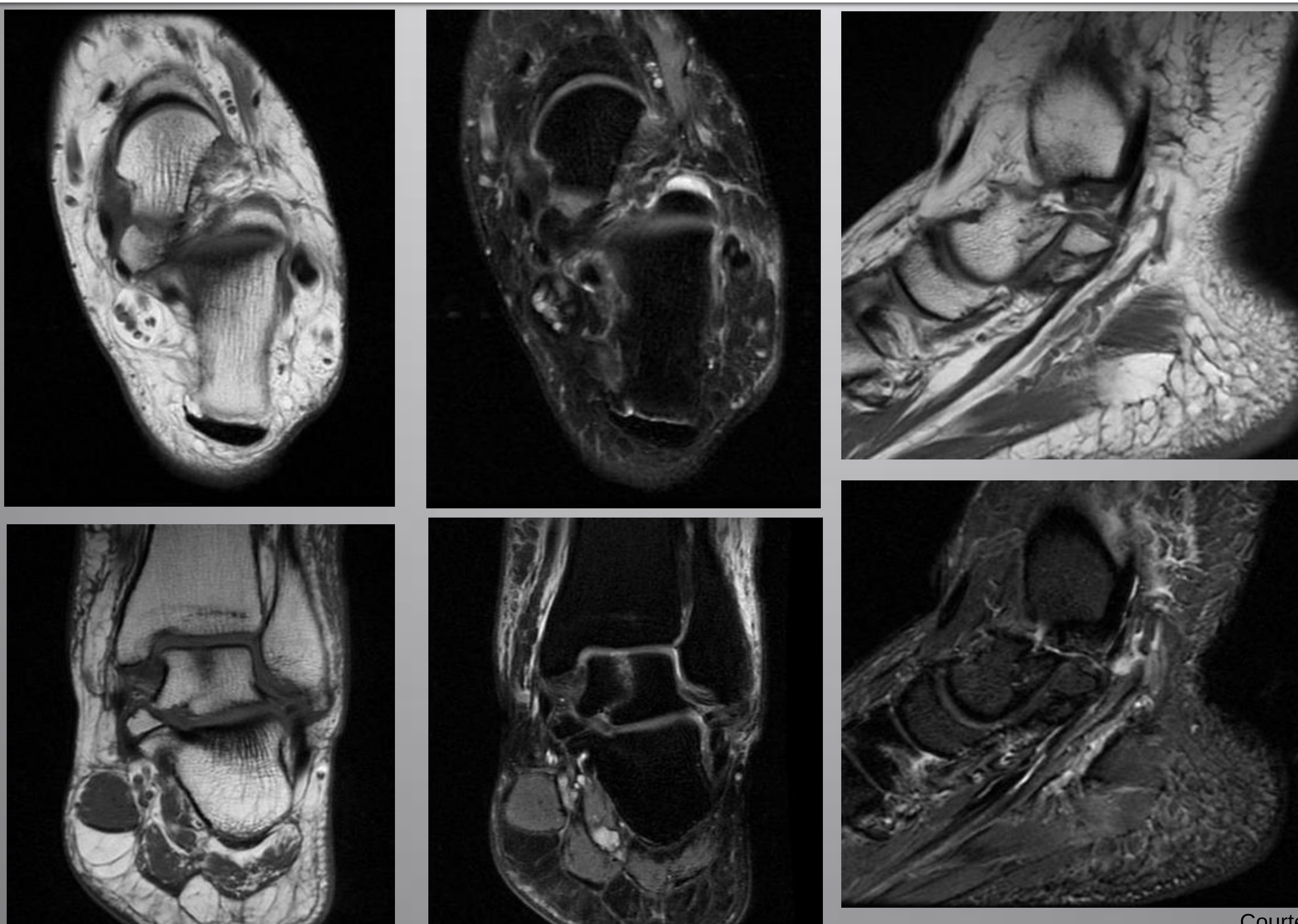
Os Sustentaculi

- Located at posterior aspect of sustentaculum tali
- May be painful
  - Chronic shearing forces
  - Resultant degenerative changes
- Should be differentiated from rare isolated fracture of sustentaculum tali
  - Irregular margins and absence of complete cortication

Os Sustentaculi

Courtesy of Dr. Brady Huang

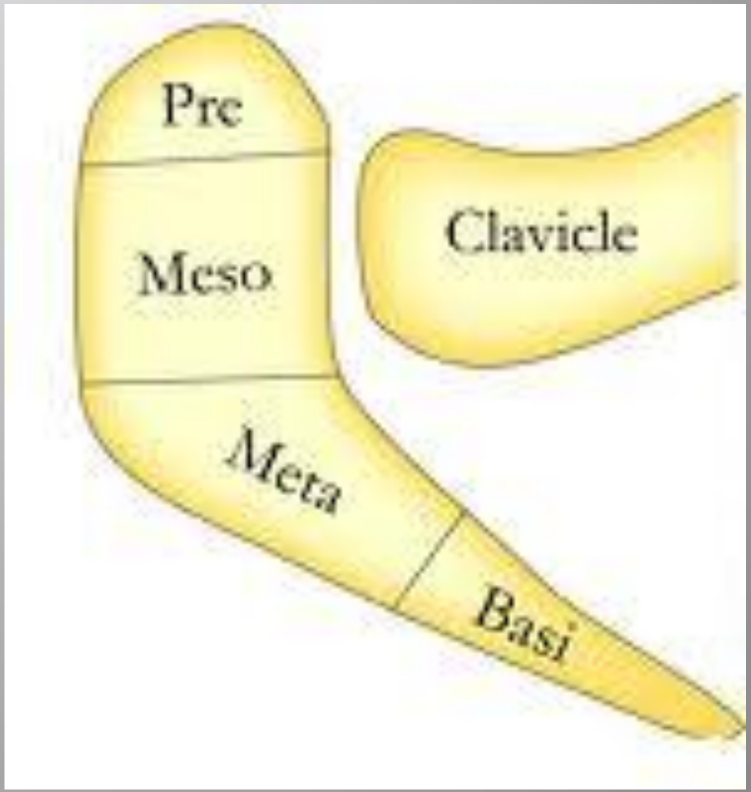
Os Sustentaculi Versus Avulsion Fracture



Courtesy of Dr. Mina Zakhary

Os Acromiale

- Results from failure of fusion of one of three acromial ossification centers
  - Pre-acromion
  - Meso-acromion
  - Meta-acromion
- Can lead to shoulder impingement syndromes
  - Downward pull of deltoid muscle impinging on rotator cuff



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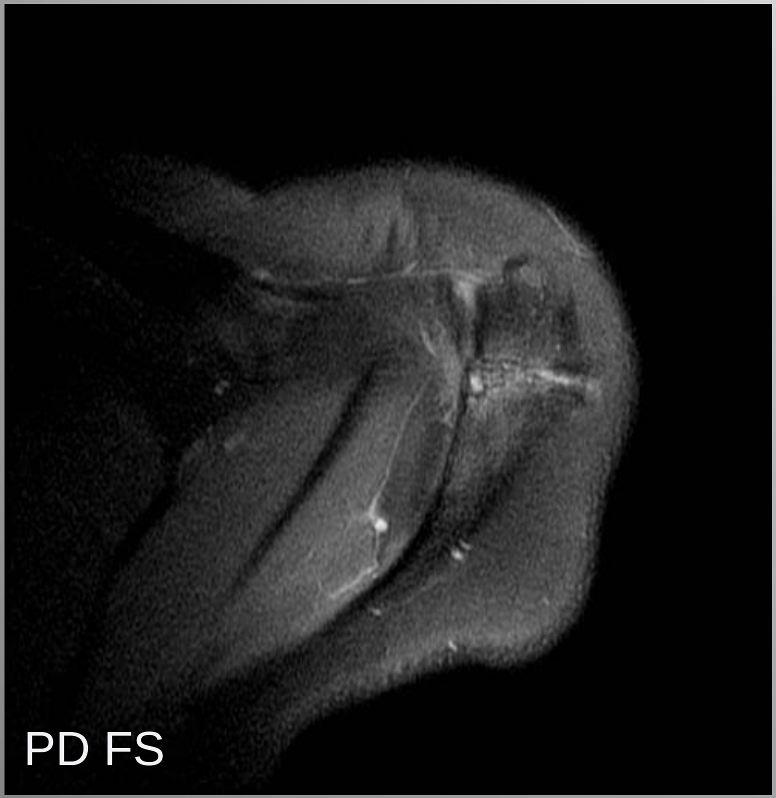
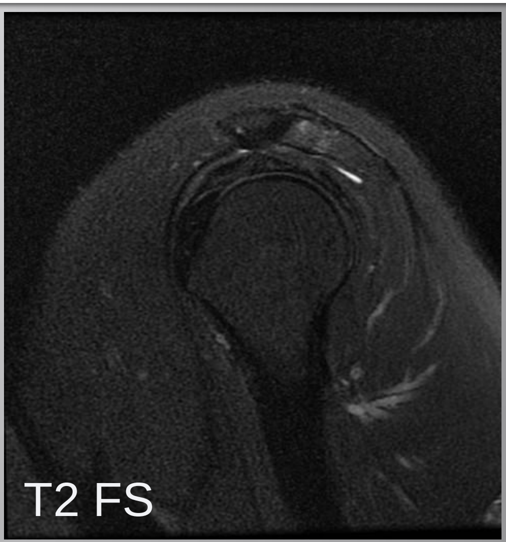
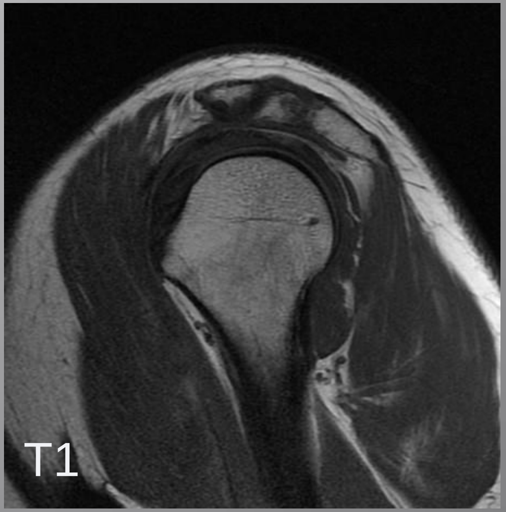
Os Acromiale

Courtesy of Dr. Brady Huang

Os Acromiale





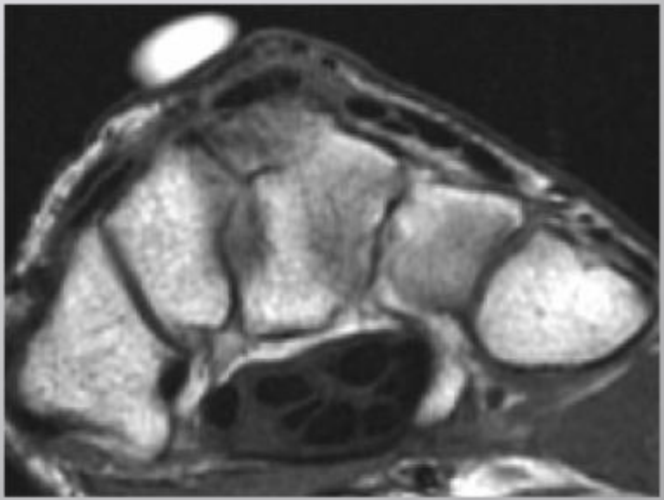


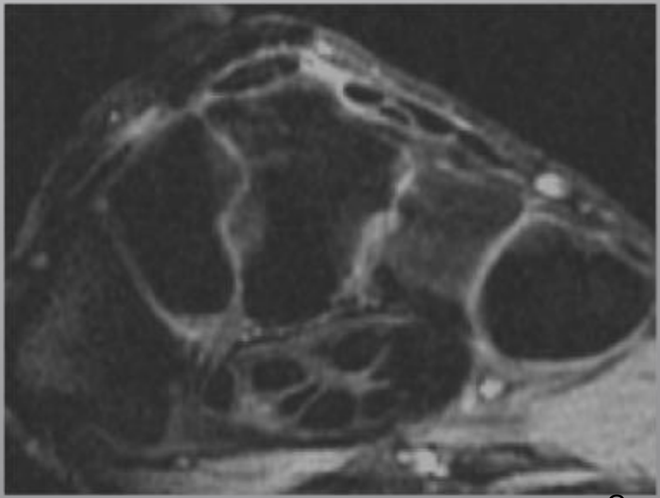
Courtesy of Dr. Brady Huang

Os Styloideum (Carpal Boss)

- Located at dorsal base of 2nd and 3rd metacarpals
- Carpal boss = unmoveable bony protruberance
  - Os styloideum
  - Degenerative osteophyte formation
- Can be symptomatic
  - Overlying ganglion or bursitis
  - Exterior tendon over bony prominence
  - Osteoarthritic changes

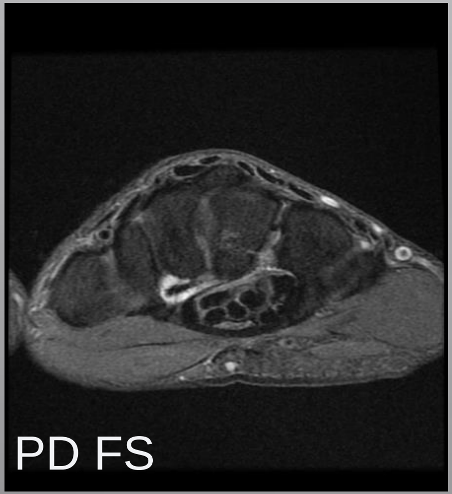
Carpal Boss





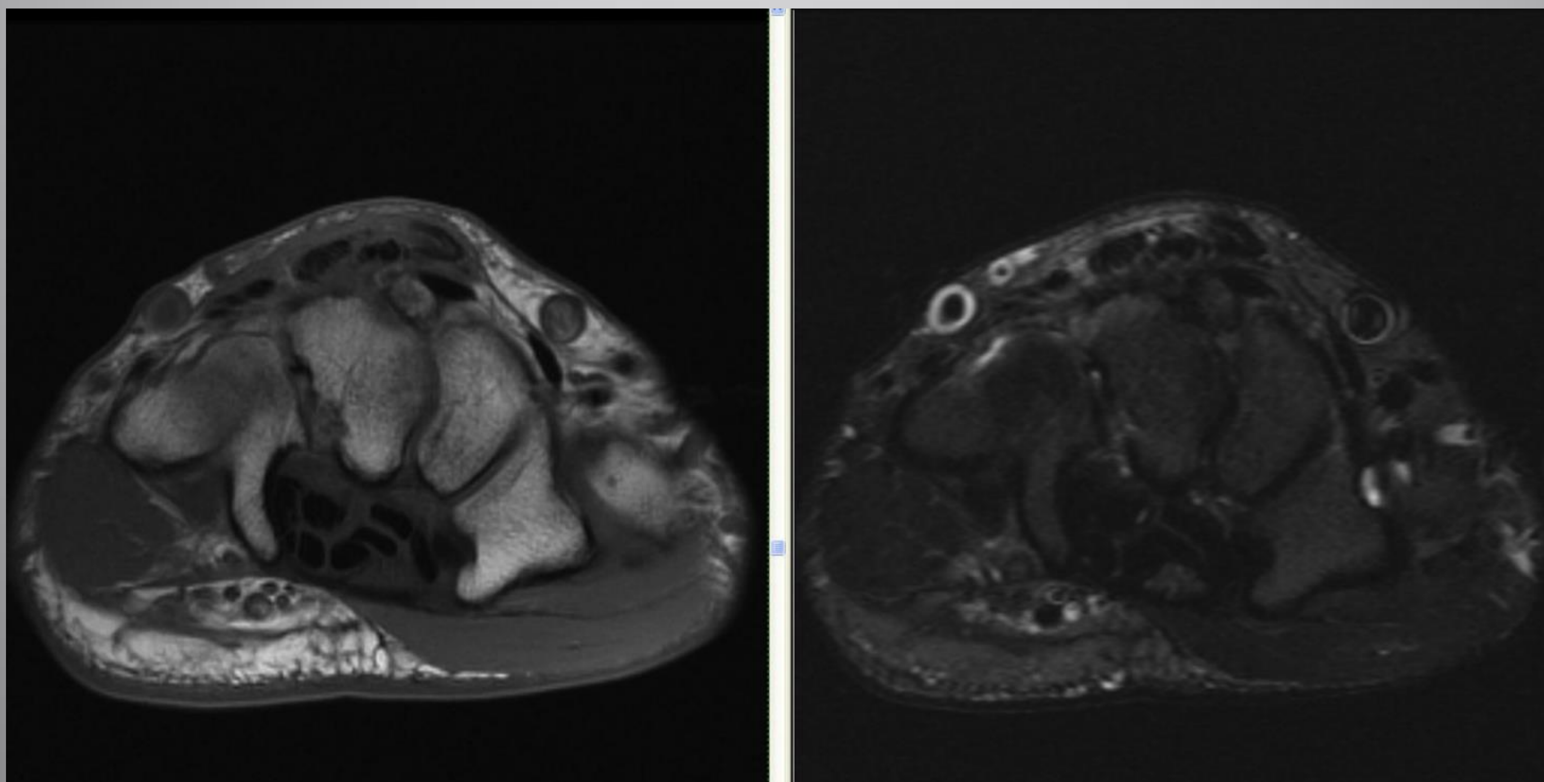
Courtesy of Dr. Donald Resnick

Carpal Boss



Courtesy of Dr. Brady Huang

Carpal Boss and Extensor Digitorum Tendinosis



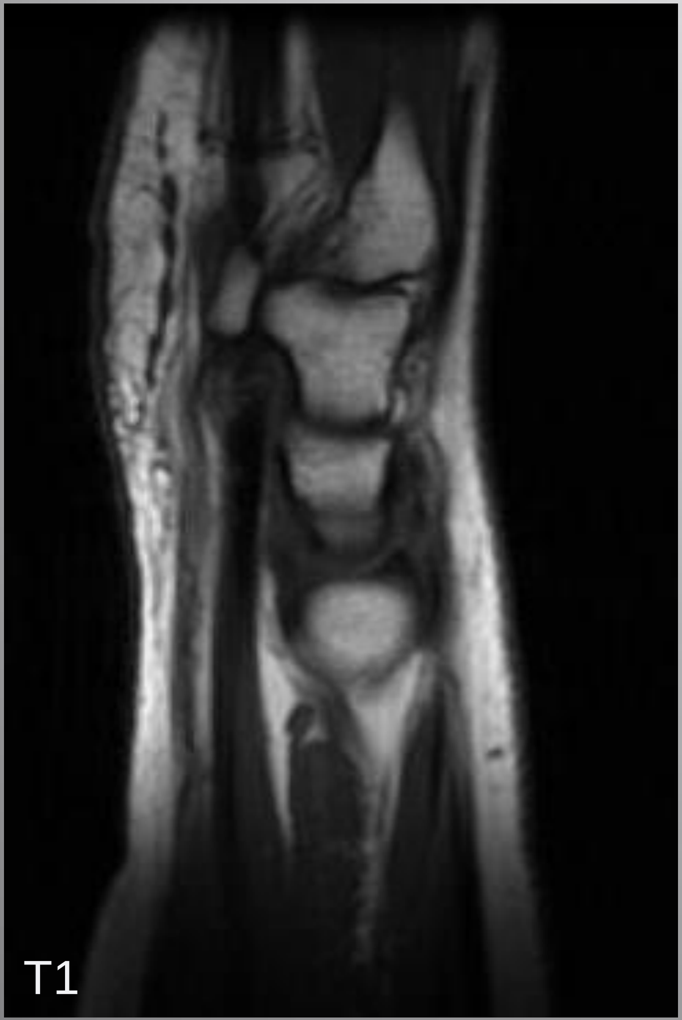
Os Hamuli Proprium

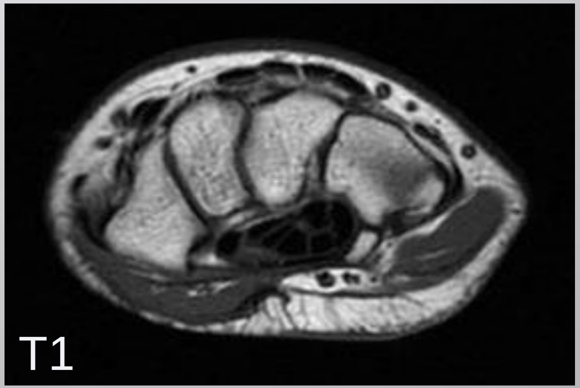
- Unfused hook of hamate
- Can be difficult to differentiate from hook of hamate fracture

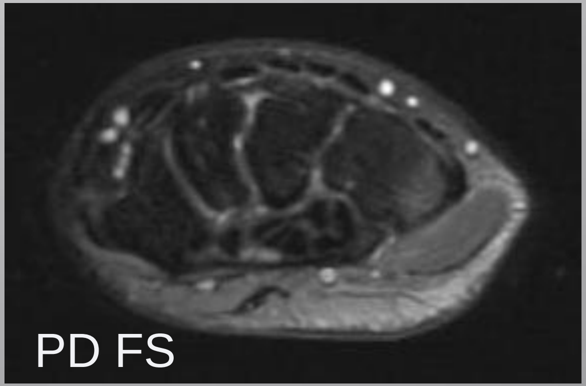
Os Hamuli Proprium

Courtesy of Dr. Brady Huang

Os Hamuli Proprium Versus Sequela of Remote Hamate Fracture

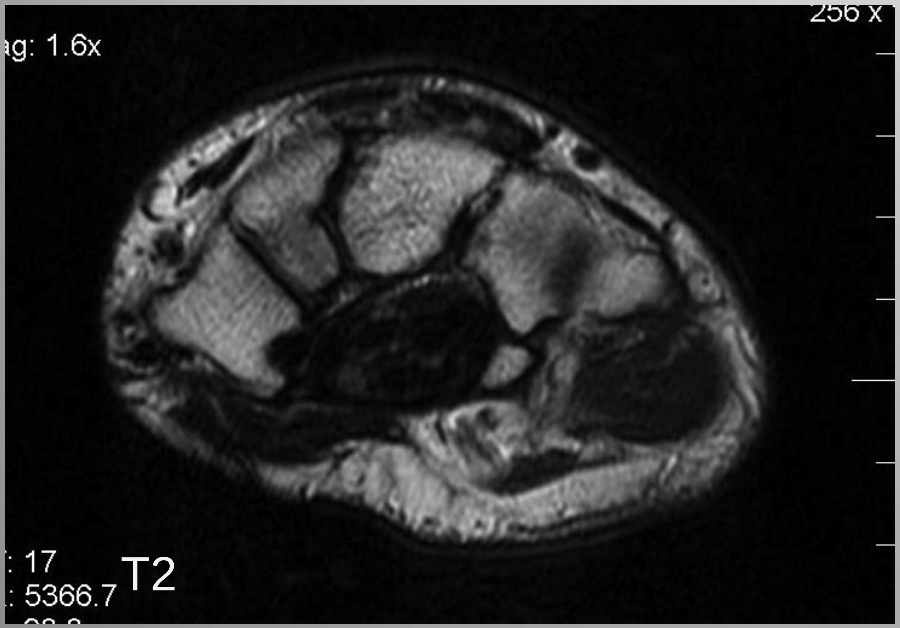


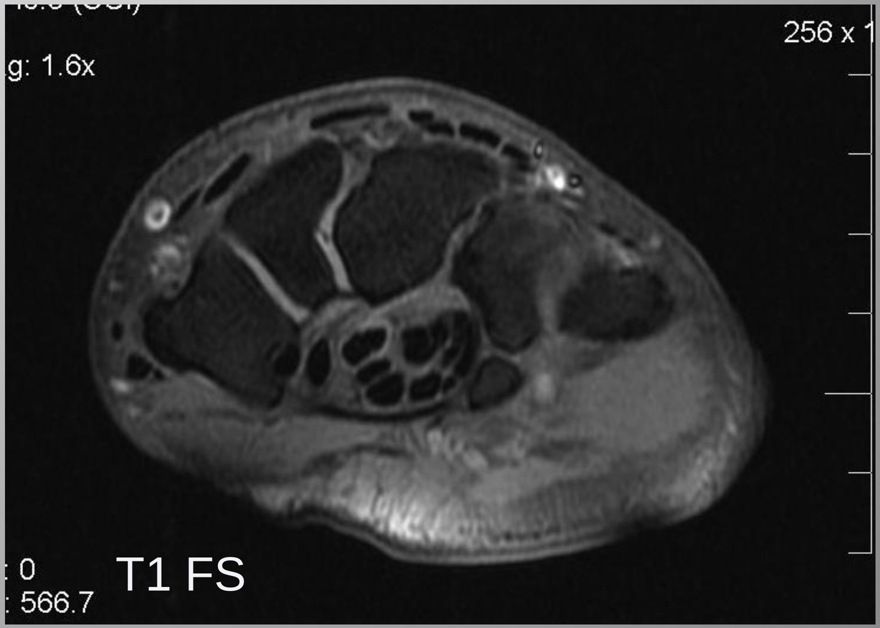




Courtesy of Dr. Evelyne Fliszar

Os Hamuli Proprium Versus Sequela of Remote Hamate Fracture





Courtesy of Dr. Donald Resnick

Ossicle Versus Avulsion Fracture

- Os calcaneus secondarius
  - Versus avulsion fracture of anterosuperior calcaneal process
- Os subtibiale
  - Versus avulsion fracture of medial malleolus
- Os subfibulare
  - Versus avulsion fracture of lateral malleolus

Old Trauma Versus Os Calcaneus Secondarius

Courtesy of Dr. Brady Huang

Conclusion – Little Bones

- Vary in prevalence and appearance
- Usually incidental findings
- Important to know normal anatomy
- May be associated with pathological conditions and produce functional disturbances

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